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Graduate, Undergraduate, *and* Non-Academic Courses

1970-1971



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CURRENT SERIAL RECORDS

GRADUATE SCHOOL

UNITED STATES DEPARTMENT
OF AGRICULTURE

EDUCATION FOR THE GOVERNMENT COMMUNITY

Calendar for 1970–1971

FALL SEMESTER

Sept. 12–19	Registration (Late fee charged after Sept. 19)
Sept. 21–25	Classes begin
Oct. 2	Last day of course transfer without late fee
Oct. 16	Deferred payments due
Oct. 30	Deadline for credit-audit change
Nov. 11	Veterans Day—no classes
Nov. 26	Thanksgiving Day—no classes
Dec. 24–Jan. 1	Christmas holidays—no classes
Jan. 4	Classes resume
Jan. 15	Close of fall semester *

SPRING SEMESTER

Jan. 23–30	Registration (Late fee charged after Jan. 30)
Feb. 1–5	Classes begin
Feb. 12	Last day of course transfer without late fee
Feb. 15	Holiday for George Washington's Birthday—no classes
Feb. 26	Deferred payments due
Mar. 12	Deadline for credit-audit change
May 21	Close of spring semester *

SUMMER SESSION

June 1–5	Registration (Late fee charged after June 5)
June 7–11	Classes begin
June 11	Last day of course transfer without late fee
June 18	Deferred payments due
June 25	Deadline for credit-audit change
July 5	Holiday for Independence Day—no classes
August 13	Close of summer session *

* Class meetings that are missed for any reason will be made up. Classes are not held on days when Government offices are closed early or all day due to hazardous weather conditions.

CATALOG

of the GRADUATE SCHOOL *of the*

UNITED STATES DEPARTMENT OF
AGRICULTURE



FALL—SPRING—SUMMER

1970-71

*Please keep this catalog for use in the
Spring and Summer*

This Catalog, published annually by the Graduate School, contains the graduate and undergraduate programs for the fall and spring semesters and the summer session. The right is reserved to make changes in the course offerings as circumstances require. Bulletins on independent study and special programs are available upon request.

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UNITED STATES DEPARTMENT OF AGRICULTURE

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GRADUATE SCHOOL

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General Information

PURPOSE OF THE SCHOOL

The objective of the Graduate School of the United States Department of Agriculture has always been to improve the Federal Service by providing needed educational opportunities for Federal employees. The Graduate School has six main programs: resident evening, special, correspondence, international, public lectures, and the press. Graduate study is a primary interest of the School, but it also offers a large number of undergraduate as well as non-credit courses. All courses are open to qualified employees of the Federal Government and to other qualified persons as facilities permit.

FOUNDING OF THE SCHOOL

The statute that established the Department of Agriculture in 1862 gave it the responsibility to "disseminate agricultural information in the broadest sense of the word." From the beginning, employees of the Department were educators. It soon became apparent that they needed opportunity to continue their education while working.

The Secretary of Agriculture expressed in 1898 the need of the Department for an organization such as the Graduate School. There was special need for continuing education for young scientists doing research in the Department. No action was taken at that time. However, shortly after the First World War, when the demand for qualified personnel became acute throughout the Federal Government, the Congressional Joint Committee on the Reclassification of Salaries recommended that the departments of the Government give more attention to the development of opportunities within the Federal Service for the continuing education of their employees. Accordingly, the Secretary of Agriculture appointed in 1920 a special committee to explore the matter. After consideration of the findings of the committee and after consultation with leading educational institutions and other government departments and agencies, the Secretary established the Graduate School in 1921. He said at that time: "I believe those who may be able to avail themselves of this opportunity will both enrich themselves and enhance the value of the service they render."

ACCREDITED STANDING

The Graduate School does not grant degrees and has never sought that authority. It prefers to give courses of standard graduate and undergraduate quality, to assure that quality through the competence of its instructors, and to cooperate with the degree-granting institutions. A student should consult *in advance* of registration with the college or university from which he wishes to receive academic credit for courses taken in the Graduate School.

The United States Civil Service Commission accepts the credits of the Graduate School, for examination and qualification purposes, on the same basis as those from accredited colleges and universities.

ADMINISTRATION

The government of the Graduate School is vested in a General Administration Board appointed by the Secretary of Agriculture. The functions of this Board are similar to those of a board of trustees of a college or university. The School is administered by a director and a small administrative staff. It is nonprofit and receives no Federal funds.

The resident evening program in Washington is organized into eight departments. Each department is directed by a departmental committee composed of a chairman and members of recognized competence in a particular field. The committees organize and give general administrative direction to the curricula of the departments. Some departments are divided into smaller academic areas and are directed by subcommittees subject to the approval of the departmental committee. There is also a Special Program Committee to advise on offerings designed for particular needs of departments and agencies of the Federal Government. The eight departmental chairmen, together with the chairmen of the Special Program and Independent Study Committees, make up the Council of the Graduate School. The Director serves as chairman. Similar committees direct other activities.

TEACHING

The faculty of the Graduate School is recruited mainly from scholars employed in the Federal Service. Most faculty members have taught in the colleges and universities in the United States and abroad before joining the Federal Government. They want to maintain academic contacts and like to teach. Thus they are attracted to the Graduate School. Because their positions in the Federal Government relate closely to the subjects they teach in the evening, they bring a fresh academic point of view and a practical approach to the classroom.

LIBRARY RESOURCES

The student body of the Graduate School has access to the noted library facilities in the capitol of the United States. There is a large library in the Department of Agriculture, containing more than one million volumes on agriculture and other subjects. Supplementing the Department Library is a collection of books supplied by the Graduate School. In addition, students can draw upon the rich storehouses of the Library of Congress, the Smithsonian Institution, the National Archives, and other exceptional special libraries.

CERTIFIED STATEMENTS OF ACCOMPLISHMENT

Certified statements of accomplishment are offered in accounting, administrative procedures, editorial practices, financial management, general engineering, graphic arts, library technician, natural history field studies, oceanography, public administration, statistics, surveying and mapping, and systems design. A student interested in working toward a certified statement of accomplishment in any of these fields should plan his proposed course of study with the Registrar. The requirements for each statement are listed under the appropriate Department in this volume.

The certified statement of accomplishment is offered to encourage the student to complete a well-rounded program in his chosen field of study. Each student who receives a certified statement is also given a transcript of his record. This is useful as public evidence of qualification. At the request of the student, an official transcript is sent to the institution or agency designated by him.

Regulations and Procedures

ADMISSION

All qualified employees of the Federal Government and other qualified persons are eligible to be admitted to resident and correspondence courses in the Graduate School.

ENTRANCE REQUIREMENTS

The Graduate School does not offer degree programs. Consequently the requirements for entrance depend upon the level of the course for which the student is registering.

Undergraduate courses are open to graduates of a standard high school or to persons who have demonstrated that they have achieved an equivalent educational level. For admission to more advanced courses, college work in the same or related field is presumed. Specific prerequisites are stated for admission to many courses. A student is expected to have completed the first semester of a year course before he may register for the second semester.

FEDERAL TRAINING LEGISLATION

Under the authority of the Government Employees Training Act (Public Law 85-507), Federal departments and agencies have authority to pay for training of employees in non-Government facilities when training is necessary and not reasonably available within Government. By training is meant "the provision of opportunities to acquire skill or knowledge related to the work of the respective Federal agencies." The Graduate School is a non-Federal facility, and, through contractual arrangements, the tuition fees and related expenses of a Federal employee can be paid by his agency. The student should make these arrangements with his supervisor or personnel office in *advance* of registration.

VETERANS

Graduate School evening courses are available to veterans under the provisions of the Veterans Readjustment Benefits Act of 1966 (Public Law 89-358). Registration for part-time study is charged against educational benefits only in the proportion that the number of semester hours bears to a full normal load.

A veteran who is entering the Graduate School is advised to consult the Registrar in *advance* of registration so that approval of a program can be obtained from the Veterans Administration.

COUNSELING SERVICES

Officers of the Graduate School are available throughout the registration periods and from 9:00 a.m. to 5:00 p.m. each weekday for counseling on educational plans in the Graduate School, or elsewhere.

TRANSFER OF ACADEMIC CREDIT

A student cannot assume that academic credit for work done at the Graduate School will be accepted by any particular college or university. Such credit is generally granted on the basis of the individual courses taken, the over-all program of the student, and the quality of the work done by the student.

A student who wishes to take an advanced degree should consult in *advance* the dean of the graduate school of the university in which he wants to become a candidate for a degree. He should obtain approval in *advance* for any courses in the Graduate School that he wants to use toward his degree. The student who is deficient in basic undergraduate courses required before undertaking graduate work can find many such courses in the large undergraduate program of the Graduate School. Others are available in the local colleges and universities.

A student who is interested in working toward an undergraduate degree should similarly consult in *advance* the dean of the institution from which he hopes to receive the degree if he wishes credit for work taken at the Graduate School.

REGISTRATION

The registration period for each semester is shown on the calendar on the inside front cover. A late fee for each course is charged for registration after the opening of the semester. After the second week of classes in the fall and spring semesters, and after the first week in the summer session, a student may register for credit only with the approval of the instructor and the Registrar. Registration is not completed until the required fees have been paid.

COURSE LOAD

A student who is employed full time may carry more than two courses only with the permission of the Registrar.

FEES

Course Fees. The tuition charge is in general \$22.00 for each semester hour credit.

Late Fees. A fee of \$2.00 for each course is charged for late registration. A fee of \$1.00 for each course is charged for late transfer.

Reinstatement Fees. A fee of \$2.00 for each course is charged for reinstatement to the student who fails to meet payments when due, in addition to all accrued fees.

Laboratory Fees. Laboratory or materials fees are listed in the *Schedule of Classes* for each semester, in connection with the courses for which they are charged.

Service Fee. A fee of \$1.00 for each course is charged the student using the deferred payment plan.

Transcript Fee. A fee of \$1.00 is charged for each copy of a student record on the regular Graduate School form or on the form of another institution or state board of education.

These are current fees and are subject to change.

Fees are due and payable in advance at the time of registration. Registration is not completed, and no student is permitted to attend classes until all fees have been paid.

An arrangement can be made at the time of registration for payment of fees in two installments, one half and a service fee at the time of registration, and the balance by the end of the fourth week in the fall and spring semesters, and by the end of the second week in the summer session. After the first two weeks of classes, fees must be paid in full at the time of registration.

A student who fails to meet payments when due will be suspended and may not attend classes until he has been reinstated and has paid all accrued fees as well as a reinstatement charge of \$2.00 for each course.

All fees are payable at the Graduate School Office, Room 1031, South Building, U. S. Department of Agriculture, Washington, D. C. 20250.

ATTENDANCE AT CLASSES

Students are expected to attend all meetings of classes and not to be absent without adequate reason.

Absence does not relieve the student from responsibility for work required while he was absent, and the burden of proof that the work has been done rests with the student. In courses in which the work cannot be satisfactorily tested by written examination, the instructor shall be the judge of the relation of the student's attendance or nonattendance to his grade. A student registered for credit who is absent more than 25 per cent of the class periods receives a mark of "W," withdrawn, unless he makes up all required work. Auditors who are absent more than 25 per cent of the class periods receive the mark of "W."

CREDIT AND GRADES

Academic Credit. The student registering for academic credit must satisfy all prerequisites for admission to the course as generally stated, or as specified in the course description.

Audit. An auditor must meet the same prerequisites as a credit student. He receives full privileges of class participation if he chooses to exercise them. An auditor does not receive a grade. He receives the mark "AUD."

Change from Audit to Credit. A student may change his registration from audit to credit, or vice versa, within 30 days after the beginning of the semester in the fall and spring, and within two weeks after the beginning of the summer session. The request for change must be made in writing to the Graduate School. Special forms are available at the Business Office.

Grades. At the close of the semester, the student receives written notice by mail of the grades he has received. The following letter grades are used:

A	Excellent	F	Failure
B	Good	Aud	Auditor
C	Fair	Inc	Incomplete
D	Passable	W	Withdrawn

TRANSCRIPT OF RECORD

Inclusion in Personnel Record for Department of Agriculture Employees. To aid in effecting its promotion-from-within policy, the Department has provided (USDA Administrative Regulations, Title 8, Chapter 42, paragraphs 1548-1551, dated 10-13-48) that a record of Graduate School credits earned by its employees is to be placed in official personnel files of the agency. Unless specifically requested by the employee that such action not be taken, the Graduate School forwards, upon completion of the courses or at the end of the year, a copy of the student's record, without cost to the employee, to the personnel officer of the unit of the Department of Agriculture in which the student is employed.

Transcripts for Employees of Other Agencies. The student who is not an employee of the Department of Agriculture can obtain an information record or transcript

for his personnel file or for other purposes by requesting such a record in writing from the Graduate School. There is a charge of \$1.00 for each information record or transcript.

WITHDRAWAL AND REFUNDS

Application for withdrawal from Graduate School classes must be made in writing to the Registrar. A form for this purpose is available in the Office. *To report the dropping of a course to an instructor does not constitute official withdrawal.* Permission to withdraw is not given to a student who does not have a clear financial record.

Refund of tuition fees *only* can be granted in cases of official withdrawal according to the following schedule:

<i>Fall and Spring Semesters</i>	<i>Refund</i>
During the first and second weeks of the semester	Tuition less \$5.00 registration fee for each course. (A minimum of \$5.00 for each course will not be refunded.)
During the third and fourth weeks of the semester	60 per cent of the total tuition.
During the fifth and sixth weeks of the semester	50 per cent of the total tuition.

Summer Session

During the first week of the session	Tuition less \$5.00 registration fee for each course.
During the second week of the session	60 per cent of the total tuition (A minimum of \$5.00 for each course will not be refunded.)
During the third week of the session	50 per cent of the total tuition.

Refunds are computed as of the date that the application for withdrawal is received in the Graduate School Office. In no case can tuition be reduced or refunded because of nonattendance at classes. No refund is made of laboratory or other incidental fees.

Because commitments for instruction and other arrangements are necessarily made at the beginning of the semester, no refunds for any reason can be made except in accordance with the schedule.

The Graduate School reserves the right to cancel any course if registration does not warrant continuance; to limit, to discontinue, to postpone, or to combine classes; to change instructors; to change classroom assignments; to make any changes deemed advisable in registration and in fees; and to require the withdrawal of any student at any time for such reasons as the Graduate School deems sufficient.

Programs

SPECIAL PROGRAM

The special program of the Graduate School is designed to develop special educational offerings in cooperation with one or more Federal departments and agencies. Such offerings include conferences, specially developed courses, institutes, pilot programs, seminars, short courses, and workshops. All these are intended to assist Federal departments and agencies in meeting new, difficult, and changing educational and training needs.

Among the special activities regularly operative in the Graduate School are management development programs for Federal executives and field managers, statistical methods for Federal executives, automatic data processing seminars, and others. Other special courses include technical writing, supervision and management, power systems engineering, and Federal personnel management.

For more information about the special program, contact the Assistant Director, Graduate School, U. S. Department of Agriculture, Washington, D. C. 20250.

INDEPENDENT STUDY PROGRAM

The independent study program of the Graduate School is designed primarily for field employees of the Federal departments and agencies. However, the courses are open to others as facilities permit. In addition, there are many correspondence courses offered by colleges and universities that are useful for Federal employees. The Graduate School is happy to assist a student in locating such courses. For additional information, write to the Head, Independent Study Program, Graduate School, U. S. Department of Agriculture, Washington, D. C. 20250.

PUBLIC LECTURES

The Graduate School presents public lecture series on current problems in agriculture and science, as well as in national and international affairs for employees of the Federal departments and agencies and others. Lectures that relate directly to the needs and interest of Federal employees are given during official working hours.

PUBLICATIONS AND PRESS

The publications of the Graduate School include:

A general annual *Catalog*.

A *Special Program Bulletin*.

A schedule of resident evening courses, issued each semester—fall, spring, and summer.

An *Independent Study Bulletin*, listing courses given by correspondence.

Books and pamphlets, published at irregular intervals. These are original contributions by members of the faculty, special lectures devoted to the advancement of the arts and sciences, and significant studies by employees of the Department of Agriculture, which the Department has been unable to publish.

RESIDENT EVENING PROGRAM

Courses offered in the resident evening program during the academic year 1970-71 are listed on the following pages by department of instruction. The departments are listed alphabetically.

The word Fall, Spring, or Summer shows the semester in which the course is offered. The number of credits shows the value of the course in semester hours. Bracketed numbers show courses that will not be offered in 1970-71.

Courses numbered 1-100 are non-credit; 100-399, undergraduate; 400-699, advanced undergraduate (senior) and graduate; above 699, graduate only.

Biological Sciences

DEPARTMENTAL COMMITTEE

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Woods

Federal Government workers in the biological sciences are increasingly faced with the difficulty of keeping abreast of rapid advances in the application of principles and new gains in basic knowledge. In addition, many other Government workers in fields indirectly related to biology need understanding of basic principles in the biological sciences to work competently in their own fields.

The Department of Biological Sciences offers courses to meet the needs of each of these groups. Unless specifically stated, there is no laboratory work. The instructors are all outstanding specialists from the Federal Government and other research institutions.

1-115. Introduction to Modern Biology

Year, 2 credits each semester

JOHN E. BUTLER

Elementary course, at college level, designed for those desiring general knowledge of structure, activities, interrelationships, and origin of plants and animals. Lectures supplemented with demonstrations. *Prerequisites*: High school biology and chemistry helpful, but not required.

1-173. Ecologic Community

Fall, 3 credits

ADOLPH M. STEBLER

Survey of basic concepts of ecology. Interrelations and dynamism of organisms and their environment. Emphasis on ecology of man. *Prerequisite*: Basic biology, or equivalent.

1-175. Pollution in Biology

Fall, 2 credits

CHARLES R. WALKER

Physical and chemical characteristics of aquatic environment and effects of different forms of pollution. Biotic responses resulting from these changes. Economic and political considerations. Philosophy of water utilization. Conservation and pollution abatement. Methods for measurement and detection of pollution. Management problems associated with water pollution and abatement. Current research.

1-176. Estuarine Fisheries and Ecology

Spring, 2 credits

CHARLES R. WALKER

Physical and chemical properties of estuary. Factors influencing ecological succession and existence of biotic communities. Energy flow through ecosystem. Commercial and recreational uses associated with flora and fauna, with particular emphasis on fisheries. Current problems in research, management, and utilization of resources dependent upon estuarine ecosystem.

1-704. Nation's Natural Environment

Fall, 4 credits

WILLIAM R. VAN DERSAL, NORMAN A. BERG, and ASSOCIATES

Designed to review and evaluate ways in which various environments of United States have been and are being affected by Americans. Landscape changes following settlement. Soil erosion. Sedimentation of streams. Thermal pollution of streams. Sewage. Industrial wastes. Persistent chemicals. Agricultural wastes. Radioactive wastes. Floods. Destruction of estuaries. Pollution and fisheries problems of inland waters and of ocean littoral. Atmospheric problems, including smog, dust storms, gaseous composition changes, and radioactive substances. Changes in wildlife populations, rare and vanishing species, and extermination of species. Ecological concepts including habitats, biological communities, food chains, plant succession, variety, and others. Existing and needed programs in soil conservation, forestry, parks, refuges, range, wilderness, and natural communities. Urban and recreational planning.

1-126. Medical Terms Simplified

Fall, 2 credits

CONSTANTINE J. GILLESPIE

Designed for medical coders, librarians, secretaries, and others workers in health field who deal with technical medical terms. Fundamentals of medical etymology. Anatomical terminology for various body systems. Names and causes of diseases and infectious processes according to body systems. Previous experience in health work helpful, but not required.

1-516. Data Processing in Medicine

Fall, 3 credits. Repeated in Spring

KENNETH L. BOWEN

Designed to give medical personnel appreciation of scope of data processing and understanding of basic principles of computers. Application to hospitals, clinics, research laboratories, and related health-service areas. Basic components of computers. Computer number systems and coding schemes. Stored program concept. Elements of programming. Brief history of data processing. General background for understanding problem-solving approaches necessary with computers. Examination of several examples of computer systems in current operation within medical field. Not programming course, but intended solely to give management and technical personnel overall view of computer as tool in medical field. *Prerequisite:* Professional status, *i.e.*, hospital staff personnel, nurse, pharmacist, laboratory, technician, physician, or other related professional personnel, or special permission.

1-370. Fundamental Principles of Microbiology

Fall, 3 credits

MATTHEW H. FUSILLO

Designed to acquaint the biology student with minimal training or experience in microbiology with theoretical aspects of microbiology. Microbial physiology. Microbial genetics. Basic immunology. Nature and genetics of bacterial and animal viruses. *Prerequisites:* Training and/or experience in biology, or special permission.

1-560. Fundamentals of Medical Microbiology

Spring, 3 credits

MATTHEW H. FUSILLO

Basic aspects of bacteriology, mycology, virology, and parasitology. Lectures on handling of clinical specimens and cultural isolation and identification techniques of specific infectious agents in each group. *Prerequisites:* Some instruction or training in clinical laboratory techniques, and/or special permission.

1-524. General Mycology

Spring, 3 credits

PHILIP B. MISLIVEC

Survey of fungi, including their morphology, ecology, identification, and pathogenicity. Special attention to those groups of fungi that are hazardous to human and animal health, emphasizing methods for proper and safe handling of these organisms. *Prerequisites:* Bachelor's degree. Some knowledge of microbiology helpful, but not required.

1-565. Fundamentals of Immunology

Fall, 3 credits

BERNARD W. JANICKI

Basic characterization of antigens, antibodies, and mechanisms of their reactions as applied to problems in biology and medicine, with emphasis on infectious diseases. *Prerequisites:* Advanced course in microbiology and/or special permission.

1-425. General Pathology

Fall, 3 credits

WILLARD A. BURNS

General principles of pathology. Demonstration of preserved or fresh gross specimens. Pathologic approach to disease. Circulatory disturbances. Disturbances of growth and development, excluding neoplasia. Degenerative processes and disorders directly related to metabolism. Specific types of degenerative processes, inflammation including general considerations, bacterial, hypersensitivity, viral, and rickettsial. Neoplasia including general characteristics, benign, malignant, and specific cancers.

1-426. Pathology of Individual Organs and Systems

Spring, 3 credits

WILLARD A. BURNS

Pathology of individual organs and systems. Heart and blood vessels. Respiratory system. Urinary system. Female genital tract. Male genital tract. R. E. system. Liver, gall bladder, and bile ducts. Pancreas. Endocrine glands. Skin. Brain and meninges. Organs of locomotion. Alimentary system and peritoneum. Oral cavity. Nose and paranasal sinuses.

1-146. Applied Physiology

Year, 3 credits each semester

LEON J. GREENBAUM, JR.

Elementary human physiology. Functions of cardiovascular system, lungs, kidneys and body fluids, nervous system, and endocrine system. Adaptations of each of these integrated systems to following environmental extremes: Increased and decreased atmospheric pressures. Heat and cold. Acceleration and motion. Closed space habitability.

1-147. Physiology of Human Development

Fall, 3 credits

LEON J. GREENBAUM, JR.

Development of man, beginning with single cell, tissue and organ differentiation, organ physiology, and ending with abnormalities of development.

1-150. Ornithology

Spring, 3 credits

DONALD H. MESSERSMITH

Basic considerations of morphology, evolution, and adaptations of birds. Life histories and ecology of important groups. Classification and identification. Five Saturday field trips.

[1-415.] Advanced Ornithology (1971-72 and alternate years)

Spring, 3 credits

DONALD H. MESSERSMITH

Detailed discussions of bird biology, distribution, classification, identification, ecology, and conservation. Individual projects and written reports. Four Saturday field trips. *Prerequisite:* Ornithology, or equivalent, or special permission.

1-420. Plant Physiology

Spring, 2 credits

LOWELL W. WOODSTOCK

General introduction, to plant physiology stressing themes of information, structure, energy, environment, and evolution. Cells, cell organelles, and membranes. Roles of nucleic acids, proteins, and enzymes in plant metabolism. History of plant physiology. Synthetic processes in plants. Photosynthesis. Respiration. Mineral nutrition. Water economy of plants. Growth and development. Plant hormones. Auxin and control of growth. Physiology of reproduction. Seed germination. Tissue differentiation. Plants and their internal and external environment. Origin of life and evolution of plants. *Prerequisites:* College biology and chemistry desirable, but not essential.

1-707. Advances in Plant Biochemistry (1970-71 and alternate years)

Fall, 3 credits

GIDEON W. SCHAEFFER

Designed primarily for graduate students, research scientists, and others interested in current developments in specified areas of plant biochemistry, physiology, and development. Designed to cover fundamentals of nucleic acid biochemistry, regulation, and synthesis. Methylation of nucleic acids. Mechanism of virus infections. Some aspects of somatic hybridizations and related cellular biology. Guest lecturers.

[1-713.] Regulation of Cell Metabolism (1971-72 and alternate years)

Fall, 3 credits

MORRIS LIEBERMAN

Designed for graduate students, working scientists, and technicians desiring to update and upgrade knowledge in biochemical control mechanisms at cellular level. Energy flow in universe. Membrane structure and function. Homeostasis. Allosteric enzymes and allosteric control. Control of metabolic pathways. Energy metabolism and its control. Hormones and regulation. Control at level of gene. Related topics. *Prerequisites:* Bachelor's degree in biology or chemistry with courses in organic chemistry, biochemistry, and physiology, or equivalent, or special permission.

1-580. Biochemistry and Physiology of Fruits (1970-71 and alternate years)

Fall, 2 credits

MIKLOS FAUST

Pathways and control of biochemical reactions specific for bulky plant organs. Carbohydrate metabolism. Pectin metabolism. Acid formation. Development of phenolic compounds. Theories of fruit ripening. Biochemical considerations for controlled atmosphere storage of fruits. Color development. Softening. Metabolic disorders of fruits. *Prerequisite:* For the advanced student with background in biochemistry, or doing research in broad area of fruit physiology.

1-570. Design of Experiments in Biological Sciences

Year, 2 credits each semester

E. JAMES KOCH

Principles of planning and analyzing animal and plant experiments. Basic design principles of completely randomized, randomized block, Latin Square, factorials, confounding, split plot, lattices, incomplete blocks, and other designs. Principles and application of correlation, regression, covariance, multiple regression, experimental and sampling errors, components of variance, missing data, mean separation, individual degrees of freedom, size, or plot, and size of experiment to experimental design. *Prerequisite:* Course in experimental statistics, several years of experience in applying principles of statistics to experimental data, or special permission.

3-490. Application of Experimental Statistics to Biological Problems (See P. 48)

5-666. Biological Oceanography (See P. 72)

7-504. Public Policy and Environmental Pollution—Seminar
(See P. 99)

SPECIAL PROGRAM IN NATURAL HISTORY FIELD STUDIES

The following courses form a special program in natural history field studies given in cooperation with the Audubon Naturalist Society of the Central Atlantic States, Inc. These courses are intended to increase knowledge and enjoyment of the natural world around us. They are also designed to help teachers, youth leaders, and parents in presenting subject matter in natural history and conservation. They provide experience in using the outdoors as a classroom and in using natural materials in the school. They are of value to professionals concerned with outdoor recreation and open-space programs.

The courses are presented at a level to appeal to adults with a high school or college education, but without advanced training in natural sciences. Field trips offer opportunity to observe in nature the subjects studied. The trips are planned to visit all the major ecological communities of the Central Atlantic region in the three-year series.

The student who satisfactorily completes the prescribed program for credit will receive a Certified Statement of Accomplishment in Natural History Field Studies. Any of the courses may be taken separately, but the entire series is planned as an integrated unit to provide an understanding of the ecology of the Central Atlantic region. The student can expect maximum benefit from taking the courses in the listed order. The certified statement of accomplishment program can be completed in two years by completing the introductory and first-year courses in one year and the second- and third-year courses the following year. An applicant for the certified statement must file a transcript of his high school or college work before completion of his program.

INTRODUCTORY COURSES

The following courses are basic preparation for the field courses. Any college-level course in general biology is sufficient qualification for Basic Biology and in plant taxonomy for Plant Identification I and II. The student with this background may take Introduction to Outdoors and Physical Environment: Geology concurrently at the start of his program. Otherwise the introductory courses must be taken prior to or concurrently with the first-year courses.

1-132. Introduction to Outdoors

Fall, 1 credit. Repeated in Spring and Summer

BRUCE L. BANDURSKI
LEWIS A. BUCK
ROBERT H. LAVELL
BEN O. OSBORN

Outdoors as environment for man. Ecological point of view applied to study of nature and use and conservation of natural resources. Recreational and scientific uses of wilderness and inhabited areas. Methods and practices of nature study and other forms of outdoor recreation. Practical dress and equipment for outdoor living. Field trips designed for those with little outdoor experience as well as more advanced hikers. Three Saturday field trips and optional overnight camp.

1-131. Basic Biology

Fall, 1 credit

RUTH C. STROSNIER

Basic principles of life as demonstrated by examples from animals and plants. Structure, functions, classification, and adaptation of organisms.

1-142. Plant Identification I

Spring, 1 credit

MARGARET T. DONNALD and ELIZABETH B. JOHNSON

Introduction to principles of plant taxonomy and techniques of plant collection and identification. Study of woody and herbaceous specimens of principal vascular plant families of Central Atlantic Region. Laboratory practice in identifying specimens. One Saturday field trip. *Prerequisite*: Basic Biology, or equivalent.

1-145. Plant Identification II

Spring, 1 credit

MARGARET T. DONNALD and ELIZABETH B. JOHNSON

Field practice in identification of plants by use of taxonomic keys and descriptions. Study of distinguishing characteristic of higher taxonomic groups. Two Saturday field trips. *Prerequisite*: Plant Identification I, or special permission.

FIRST YEAR

1-130. Physical Environment I: Geology

Fall, 1 credit

WILLIAM E. DAVIES

Principal geological features and geologic history of Central Atlantic Region. Properties of common minerals and rocks. Influence of geology on local physical environment of organisms. Three Saturday field trips.

1-129. Physical Environment II: Weather and Climate

Fall, 1 credit

PAUL E. LEHR

Introduction to weather and climate. Nature of atmosphere, weather elements, air masses, fronts, and storms. Causes of weather phenomena. Reading and understanding weather maps and forecasts. Climates and microclimates of Central Atlantic Region. Weather and climate as part of environment of living things.

1-133. Introduction to Ecology

Spring, 1 credit

GALE MONSON

Survey of fundamental principles of ecology. Factors and dynamics of relations of organisms to their environment. Structure, function, and classification of biotic communities. Lectures and discussion designed to prepare the student for field study of biotic communities. *Prerequisite*: Basic Biology, or equivalent.

1-125. Physical Environment III: Soils and Landscape

Spring, 1 credit

JAMES D. SIMPSON

Nature of soils and their influence on environment. Structure, properties, and classification of soils, and their differences in response to human use. Life in soil. Total landscape as function of geology, climate, and soils. Soil groups and natural land resource areas of Central Atlantic Region. Three Saturday field trips. Courses in climate and geology helpful.

SECOND YEAR

1-138. Biotic Communities I: Deciduous Forests

Fall, 1 credit

RUSSELL P. KANIUKA and BEN O. OSBORN

Field studies of climax, second-growth, and early successional stages of oak-hickory, oak-chestnut, mixed mesophytic, and bottomland forests. Relation of forest types to local environment. Three Saturday field trips. *Prerequisites*: Introduction to Ecology, or equivalent. Courses in plant identification, geology, climate, and soils helpful.

1-134. Animal Behavior

Fall, 1 credit

TO BE ANNOUNCED

Introduction to behavior of principal groups of animals, with emphasis on vertebrates. Instinctive and learned responses of animals. Territory, courtship, migration, and family, social, and predatory relations. *Prerequisite*: Introduction to Ecology, or equivalent.

1-139. Wildlife Populations

Spring, 1 credit

TO BE ANNOUNCED

Geographic origin and classification of modern birds and mammals. Population dynamics. Influence of man on distribution and abundance of some species. Principles of wildlife management. *Prerequisite*: Introduction to Ecology, or equivalent. Animal Behavior also good preparation.

1-141. Biotic Communities II: Coniferous Forests

Spring, 1 credit

BEN O. OSBORN

Field study of climax, second-growth, and early successional stages of oak-pine forests of Coastal Plain, Piedmont, and Blue Ridge. Northern coniferous and deciduous forest mixtures of Allegheny Mountains. Three Saturday field trips, including overnight trip to Allegheny Mountains. *Prerequisites*: Introduction to Ecology and Biotic Communities I: Deciduous Forests, or equivalent.

THIRD YEAR

1-135. Biotic Communities III: Aquatic and Marsh

Spring, 1 credit

CHARLES R. WALKER

Field study of fresh water streams, ponds, and marshes. Brackish estuaries and bays. Brackish and salt marshes. Ocean beaches and dunes. Three Saturday field trips, including overnight trip to Eastern Shore. *Prerequisite*: Introduction to Ecology, or equivalent.

1-137. Conservation Philosophy in United States—Seminar

Fall, 1 credit

SHIRLEY A. BRIGGS

Critical reading and discussion of conservation classics. Evolution of conservation concepts in United States traced through works of Powell, Marsh, Leopold, and others. Basic concepts in ecology, philosophy, and sociology considered in relation to development of conservation ethic for individual and for society. Each student is expected to report on at least one book.

1-140. Land Use Principles

Spring, 1 credit

BEN O. OSBORN
LEWIS H. WILLIAMS

Survey of some social, economic, ecological, and physical principles that govern how land is used. Application of these principles to land resources use and conservation. Examples of land-use problems in Central Atlantic Region. Two Saturday field trips. Courses in Physical Environment, Ecology, Biotic Communities, and Conservation Philosophy good preparation.

1-152. Conservation in Action

Spring, 1 credit

RUSSELL P. KANIUKA and KATHERINE N. MERGEN

Survey of land resource conservation programs, public and private, now in operation. On-the-ground observation of typical examples in the Central Atlantic Region. Three Saturday field trips. No prerequisites, but courses in Conservation Philosophy and Principles of Land Use and Conservation good preparation.

ADVANCED COURSES

The following courses presume familiarity with the subject matter of courses in the program for the Certified Statement of Accomplishment although the Certified Statement is not a prerequisite to enrollment.

1-154. Citizens and Conservation

Fall, 1 credit

SHIRLEY A. BRIGGS and ASSOCIATES

Review of ways citizens can influence governmental and private agencies to achieve desired conservation goals. Practical experience of both individuals and organizations. Case histories of specific areas and issues, with stress on state and local situations.

1-149. Man and Environment

Fall, 1 credit

BRUCE L. BANDURSKI and ASSOCIATES

Survey, through guest lectures and class discussion, of some limiting factors of man's existence. Intra- and interactions of natural and artificial components of the environment. Rates of change, and inputs and outputs causing change, in ecosystems. Genetics of human fitness. Environmental quality on "spaceship earth."

1-156. Environmental Education

Spring, 1 credit

BRUCE L. BANDURSKI and WILLIAM L. PERRY

Needs and opportunities for increasing understanding and appreciation of natural environment. Philosophy of conservation education in schools. Classroom resources and techniques for imparting understanding. Outdoor laboratories and neighborhood opportunities for environmental study. Obtaining program information and technical assistance. Gathering support of parents and school board.

1-136. Nature Teaching—Workshop

Fall, 1 credit

GEORGIA A. BUCK

Techniques for teaching basic concepts of ecology and conservation. Emphasis on student activity projects, nature crafts, nature trails, field trip planning and leadership, and experiences designed to involve young people and adults in purposeful study of natural environment. Three Saturday field trips.

OPTIONAL COURSES

The following courses supplement the prescribed program for the Certified Statement of Accomplishment in Natural History Field Studies, but are not required for the certified statement.

1-143. Insect Life

Spring, 1 credit

FLOYD P. HARRISON

Introduction to principal insect families of Central Atlantic Region. Identification, life histories, and ecology of important insect forms. Importance of insects in biotic communities.

1-144. Rocks and Fossils

Spring, 1 credit

INSTRUCTOR TO BE ANNOUNCED

Field identification of principal rock types and typical fossils of Central Atlantic Region. Interpretation of fossil record. Three Saturday field trips to representative fossil locations. *Prerequisite:* Physical Environment I: Geology, or General Geology.

1-151. Bird Life

Fall, 1 credit

DONALD H. MESSERSMITH

Introduction to study of birds. Elementary principles of morphology and classification. Life histories and ecology of some important birds of Central Atlantic Region. Role of birds in biotic communities. Methods of field observation and identification. Two Saturday field trips.

1-153. Man in Potomac Valley

Fall, 1 credit. Repeated in Summer

EDWIN F. WESELY, JR.

Introduction to natural and human history of Potomac Valley. Geological and ecological setting. Indians. Early explorations. Tidewater civilization. Chesapeake and Ohio Canal. Civil War. Modern problems and prospects. Songs of valley. Guest speakers include former canal boatman. Four Saturday field trips.

SPECIAL PROGRAM IN PLANT QUARANTINE STUDIES

The following courses form a special in-service training program in plant quarantine studies. They are given at the New York City facilities of the Division Training Center, Plant Quarantine Division, Agricultural Research Service. The program is under the supervision of Harold S. Shirakawa, Employee Development Office, Plant Quarantine Division, Agricultural Research Service.

1-515. Plant Quarantine Entomology

Schedule to be arranged, 6 credits

Concentrated and technical course in entomology, especially designed to enable qualified and experienced selectees to fully identify foreign insect pests regularly encountered in plant quarantine work, both in adult and immature stages. To familiarize participant with dissection and mounting techniques for larval skins, genitalia, epipharynxes, and similar precise operations. To acquaint enrollee with current classification and nomenclatural concepts in insect orders under consideration. *Prerequisite:* Basic Training for Plant Quarantine Inspectors, or equivalent.

1-535. Basic Training for Plant Quarantine Inspectors

Schedule to be arranged, 7 credits

LEMAR M. CHILSON
FRANK E. COOPER
DONALD G. DODY
EDWIN M. IMAI
HAROLD S. SHIRAKAWA

Consecutive 12-week program for new Federal plant quarantine inspectors. Designed to orient the new employee in the Department of Agriculture. Its organization, function, and personnel policies. Basic legislation and other legal authorities affecting plant quarantine operations. Principles of plant quarantine enforcement. Federal-State relationships. Inspection and treatment techniques and procedures. Technical aspects of foreign pest evaluation. Identification and distribution in the fields of entomology, plant pathology, and nematology as applicable to foreign plant quarantine enforcement. Commodity recognition as applicable to plant materials moving in international commerce.

1-615. Plant Quarantine Pathology

Schedule to be arranged, 4 credits

DONALD G. DODY

Designed for regulatory officials interested in quarantine phytopathology. Emphasis on detection, recognition, and nomenclature of disease-causing organisms frequently encountered in plant quarantine operations, particularly those not known to occur or to be widely distributed in the United States.

1-708. Plant Quarantine and Plant Protection

Schedule to be arranged, 10 credits

EDWIN M. IMAI

For foreign trainees studying plant quarantine methods in United States. Organization of Department of Agriculture and interrelationships of agencies. Regulatory and control organization and policy, basic quarantine legislation, fundamental principles affecting promulgation of quarantines, and restrictive orders. Field observations and participation in operational activities of Plant Quarantine Division at ports of entry. Identification and distribution in the fields of entomology, plant pathology, and nematology as applicable to foreign plant quarantine enforcement. Review and observation of field control projects and plant operations in Northeast, Southeast, and Southwest Regions.

1-709. Plant Quarantine Nematology

Schedule to be arranged, 6 credits

Graduate level study and practice in detection, isolation, preparation, and identification of nematodes of plant quarantine significance. Special emphasis on host relationships, world distribution, and applicable treatments. Guest lecturers.

Languages and Literature

DEPARTMENTAL COMMITTEE

J. Kendall McClarren, *Chairman*

John C. Baker, Erwin Jaffe, Robert H. Land, Rupert F. Mouré, William Raspberry, Sid L. Schwartz, John Sherrod, H. Gerard F. Siems, Franklin Thackrey (*Vice-chairman*), Eleanor W. Traylor

It is of primary importance for the Federal servant to write and speak effectively. Scientists, technicians, and professional personnel especially need to know how to communicate their knowledge both to the layman and to their associates. In fact, at all levels of the Federal Government, the employee should be competent in writing and speaking. The Department of Languages and Literature offers courses at varying levels to meet these needs.

There are also available programs in editorial practices and library techniques that lead to certified statements of accomplishment.

English—Grammar and Writing

2-29. Spelling and Basic Vocabulary

Fall, non-credit. Repeated in Spring and Summer

MARY A. NEUMAN

Designed to improve spelling by intensive phonic drill in letter and syllable sounds, together with exercises in operation of basic rules of spelling. Memorization of basic list of words not conforming to sound or rule spelling. Secondary aim, acquisition—through spelling and planned vocabulary workbook exercises—of basic vocabulary at level preparatory to Vocabulary Building.

2-39. Basic Grammar

Fall, non-credit. Repeated in Spring and Summer

MARJORIE B. EDWARDS

Intensive drill on recognition of parts of speech of English sentences and their contribution through parsing. Phrases and clauses in analysis and synthesis drill.

2-112. Practical English Usage

Fall, 2 credits. Repeated in Spring and Summer

NANDO A. AMABILE
MAYME W. HOLT

Refresher course in English grammar and usage. Exercises in analyzing sentences to give the student basic knowledge of sentence structure and grammar required for more advanced courses in grammar and writing. Exercises in correct usage and punctuation.

2-35. English for Secretaries

Fall, non-credit. Repeated in Spring and Summer

NANDO A. AMABILE

Sentence structure, capitalization, punctuation, vocabulary, and spelling.

2-95. Improving Reading Ability

Fall, non-credit. Repeated in Spring and Summer

DEE W. HENDERSON

Developmental reading for average and superior reader. Designed to increase selectivity, flexibility, purpose, and speed. Individualized training. Analysis of reading, vocabulary, and visual abilities to help determine areas needing development. Workbook exercises, periodic evaluation of progress, short talks on principles of efficient reading, and practice for individual needs. Final test to determine progress and areas needing further development.

2-38. English for Foreigners I

Fall, non-credit. Repeated in Spring and Summer

WILLA B. WEEKS

Designed to improve the student's comprehension and speaking knowledge of English. Not a beginner's course. Low intermediate course for the student who already has some knowledge of English. Emphasis on comprehension, pronunciation and enunciation, word sequence, and sentence structure with correct grammatical usage. Basic course for English for Foreigners II and III.

2-52. English for Foreigners II

Fall, non-credit. Repeated in Spring and Summer

WILLA B. WEEKS

Intermediate to advanced course. Training in all communication skills—listening, speaking, reading, and writing sentences. Emphasis on comprehension, pronunciation and enunciation, word sequence, and sentence structure with correct grammatical usage.

2-53. English for Foreigners III

Fall, non-credit. Repeated in Spring and Summer

WILLA B. WEEKS

Advanced course. Designed as sequel to English for Foreigners II. Reading and comprehension of advanced English. Vocabulary building. Guided and free paragraph writing. Punctuation, capitalization, and forms in letter writing.

2-119. Vocabulary Building

Fall, 3 credits. Repeated in Spring and Summer

PETER H. GIBBON

Study of sources and origins of words to gain insight into present meanings. Principles of word formation, dictionary study, and exercises in word selection. Emphasis on common Latin and Greek roots used in forming English words.

2-222. English Composition

Year, 3 credits each semester

WILLIAM I. DANIELS
MELVIN E. ENGELHARDT
ROBERT C. REED

Equivalent of college Freshman English. Introductory course in writing and English usage, designed especially for those who need a course preparatory to more advanced English studies, and for those who want to learn techniques of expository writing. Fundamentals of good writing. Exercises in writing short and long themes and in studying, analyzing, and evaluating selected English prose texts. *Prerequisite*: High school English.

2-223. College Grammar

Fall, 3 credits

RUDOLF C. FREYEISEN

Grammatical principles, stressing sentence structure and correct English form. Study of sentence structure through diagramming and of correct English form through detailed discussion and examination of parts of speech. Lectures on history and development of inflectional and derivational forms. Analysis of examples of good and bad English. *Prerequisite*: English Composition, or equivalent.

2-250. College Rhetoric

Fall, 3 credits. Repeated in Spring

JAMES C. FREEMAN

Advanced English composition. Designed to enable the student to develop clear, concise, and effective writing style. Study and application of art and principles of composition. Stress on effective use of language and vocabulary. Examination of four basic types of discourse: Exposition, argument, description, and narration. Emphasis dependent upon needs and interests of students. Course in writing. Assignment of composition almost every week. *Prerequisite*: English Composition, or equivalent.

2-226. Official Writing

Fall, 2 credits. Repeated in Spring

ROBERT W. DOAN
WILBERT SCHAAL

Designed for those who have to write as part of their jobs, but who are not necessarily professional writers. Stresses that official Government writing, as all writing, should be clear, simple, concise, and easy to understand. Emphasis on eliminating unnecessary words and phrases in official writing. Covers many forms of Government writing including articles, reports, letters, and memoranda. Several short writing assignments. *Prerequisite*: English Composition, or equivalent in writing experience.

2-235. Fiction Writing—Workshop

Fall, 2 credits. Repeated in Spring

STANLEY FIELD

Stress on such fiction fundamentals as plotting, characterization, dialogue, story organization, testing readability and interest, and increasing dramatic quality of writing. Emphasis on writing techniques that increase salability of student manuscripts by discussing editorial taboos, ways to obtain salable story ideas, and to market manuscripts.

2-280. Feature Writing

Fall, 2 credits

MARIE A. DOLAN

Fundamentals of writing feature articles for magazines and newspapers. Lecture, discussion, and practical experience in finding salable ideas. Research. Interviewing. Market analysis and feature writing techniques basic to preparing articles for publication.

2-281. Advanced Feature Writing

Spring, 2 credits

MARIE A. DOLAN

Writing more complex feature articles. Emphasis on narrative techniques. Slanting for special markets. Illustrating, revising, and polishing manuscripts. Class discussion and criticism of student articles.

2-450. Technical Writing

Fall, 2 credits. Repeated in Spring

ROY A. CARTER

Designed to help the scientist and economist improve their research reports and articles for professional publications. Survey of fundamentals of writing the technical report: its characteristics, parts, functions, steps in preparation, and process of criticism. Preparation, criticism, and revision of reports and articles—written for official use when possible. *Prerequisite*: Undergraduate degree in one of the sciences, engineering, economics, or other technical field, or equivalent.

2-105. Techniques of Instruction

Fall, 3 credits

GERALD L. HOLLAND

Designed for instructor, training supervisor, and subject specialist conducting job instruction. Also for those presenting oral reports and briefings. Presentation and application of fundamental learning. Classification and organization of subject matter. Lesson plan formats. Methods of presentation. Oral questioning techniques. Types and uses of training aids. Training facilities and equipment. Evaluation of training results. Professional ethics. Basic communication principles.

4-330. Government Letter Writing (See P. 61)

4-421. Writing Procedures and Instructions (See P. 60)

Literature

2-215. American Literature I

Fall, 3 credits

DONALD E. KARR

Survey of development of American literature from Colonial times to Civil War. Introduction and Puritan age. Neo-classic age and Franklin. Romantic movement: Bryant, Poe, Emerson, Thoreau, Hawthorne, Melville, Whittier, Longfellow, Lowell, and Holmes.

2-216. American Literature II

Spring, 3 credits

DONALD E. KARR

Survey from Civil War to present. Introduction and rise of realism. Local colorists: Harte, Cabell, Harris, Jewett, and Dickinson. Realist movement and naturalism: Adams, Garland, Crane, Norris, Dreiser, and Howells. New poetry: Robinson, Frost, Lowell, Sandburg, Pound, and Eliot. O'Neill (*Emperor Jones*), Stevens, Jeffers, Benet, and MacLeish. The twenties: Cather, Anderson, Lewis, Fitzgerald, Hemingway, Dos Passos, Steinbeck, Wolfe, Porter, and Faulkner. Criticism and poetry as assigned.

2-330. Great Books

Year, 2 credits each semester

M. CLARE RUPPERT

Group discussion of important works in poetry, history, philosophy, and criticism. A leader helps with the reading and understanding, but the books themselves are the teacher. Designed to give insight into perennial, and therefore contemporary, problems. Interest in ideas and belief in free discussion required. Most books read in entirety. Discussion centers around the following authors:

Reading List A (1970-71 and alternate years)

Fall Semester: Bible, *Ecclesiastes*; Homer, *Iliad*; Aeschylus, *Oresteia*; Sophocles, *Oedipus at Colonus*; Plato, *Symposium* and *Republic*, Bk. VI-VII; Aristotle, *Ethics*; Thucydides, *History of the Peloponnesian War*; Epictetus, *Discourses* (Selections); Lucretius, *On the Nature of Things*.

Spring Semester: Bible, *Gospel According to St. Matthew*; Shakespeare, *Macbeth*; Milton, *Areopagitica*; Adam Smith, *Wealth of Nations*; Descartes, *Discourse on Method*; Swift, *Gulliver's Travels*; de Tocqueville, *Democracy in America*; Thoreau, *Civil Disobedience*; Kant, *Perpetual Peace*; Mill, *On Liberty*; Twain, *Huckleberry Finn*.
Reading List B (1971-72 and alternate years)

Fall Semester: *Declaration of Independence*; Bible, *Book of Job*; Homer, *Odyssey*; Sophocles, *Antigone* and *Oedipus Rex*; Plutarch, *Lives: Alexander and Caesar*; Plato, *Apology* and *Crito*; Aristotle, *Politics*, Bk. I; Marcus Aurelius, *Meditations*; St. Augustine, *Confessions*; St. Thomas Aquinas, *On the Law*.

Spring Semester: Dante, *Divine Comedy*; Machiavelli, *The Prince*; Shakespeare, *Hamlet* and *King Lear*; Hobbes, *Leviathan*; Rousseau, *Social Contract*; Locke, *Civil Government*; *Federalist Papers*; Marx, *Communist Manifesto*.

2-331. Significant Books of the Twentieth Century

Summer, 2 credits

M. CLARE RUPPERT

Books discussed in light of their influence upon twentieth century man, his thought and behavior in our contemporary society.

Reading List

James, *Pragmatism*; Frazer, *Golden Bough*; Dewey, *Democracy and Education*; Keynes, *Economic Consequences of the Peace*; Proust, *Remembrance of Things Past* (vol. I); Joyce, *Ulysses*; Mann, *Magic Mountain*; Spengler, *The Decline of the West*; Freud, *Basic Writings*; Toynbee, *Study of History* (1 v. abridged)

2-266. Novel: Comparative Study

Year, 3 credits each semester

ELEANOR W. TRAYLOR

Study of evolution of novel as form, with emphasis upon peak achievements in aspects of novel form and technique. Guided by Percy Lubbock's *The Craft of Fiction*, examination of several major novels, including but not restricted to Tolstoy, Dostoevsky, Thackeray, Flaubert, Cervantes, Henry James, Lady Murosaki, James Joyce, Virginia Wolfe, and Ralph Ellison.

2-269. Black Man in Literature as Writer, as *Persona*

Fall, 3 credits. Repeated in Spring

ELEANOR W. TRAYLOR

Study of representative selections revealing contribution of Black men to letters historically and geographically. Authors and selections include but not restricted to Solomon (the speaker as *persona* in "The Song") Othello (Spanish Moor of Renaissance as *persona*), Pushkin, Chinua Achebe, Wole Soyinka, and other American Black authors as offered in respective texts of John Henrik Clarke and Robert Hayden.

2-267. American Protest Literature

Summer, 2 credits

ELEANOR W. TRAYLOR

Study of representative selections whose themes or theses set forth salient aspects of social protest in United States. Protest of Black people, of women, and of other protest groups. Authors include but not restricted to Richard Wright, LeRoi Jones, Betty Frieden, John Steinbeck, and F. Scott Fitzgerald.

2-370. Modern Drama

Fall, 2 credits

CASPAR NANNES

Survey of development of twentieth century drama beginning with Ibsen and extending to middle of century. Henrik Ibsen (Norway), August Strindberg (Sweden), Gerhart Hauptmann (Germany), Edmond Rostand (France), Anton Chekhov (Russia), John Galsworthy, George Bernard Shaw, and Oscar Wilde (England), Eugene O'Neill, Maxwell Anderson, and Robert Sherwood (United States).

2-371. Great Figures of English Literature

Spring, 2 credits

CASPAR NANNES

Survey of great English writers, exclusive of Shakespeare, from Beowulf to twentieth century. Geoffrey Chaucer, Christopher Marlowe, Ben Jonson, John Milton, John Dryden, Jonathan Swift, Alexander Pope, Samuel Johnson, Henry Fielding, Robert Burns, Lord Byron, Percy Bysshe Shelley, Charles Dickens, William Thackeray, Alfred Lord Tennyson, and Thomas Hardy.

2-277. Twentieth Century Chinese Literature

Summer, 2 credits

CAROLYN T. BROWN

Selected literary works of Nationalist and Communist China in context of modern Chinese history. Influence of Western literature on Chinese authors. Literary revolution of 1910's. Poetry and short stories by leftist writers in 1920's and 1930's. Literature of Yenan—pre-liberation Communist literature. Function of literature in Communist China. Contemporary non-Communist Chinese literature. *Prerequisite:* Background in modern Chinese history helpful but not required.

CERTIFIED STATEMENT OF ACCOMPLISHMENT IN EDITORIAL PRACTICES

A Certified Statement of Accomplishment in Editorial Practices is granted to a student who has completed an organized program intended to provide basic training for responsible editorial and publications work. This program should be of special interest to those who want to enter editorial work and to those in editorial or publications work who want to prepare for advancement. A good educational background is essential for success in this profession. It is recommended that a student working toward the certified statement should preferably have an undergraduate degree, or at last two years of college work, or at minimum creditable work experience in a subject-matter field. An applicant for the certified statement must file a transcript of his high school or college record before completion of his program.

Requirements

1. Demonstrated facility in English grammar and composition. This requirement can be met by successful completion of an examination to be given as a part of the course, Principles of Editing and Their Application.
2. 24 semester hours of credit with an average grade of B or better in the following courses:
 - a. Required courses: (15 credits)
 - Principles of Editing (3)
 - Intermediate Editing (3)
 - Printing, Layout, and Design (2)
 - Editing Technical Manuscripts (2)
 - Producing the Popular Publication (2)
 - Advanced Practice in Editing (3)
 - b. Editing Electives: (6 credits)
 - A Foreign Language
 - Basic Reference Service and Reference Tools (2)
 - Feature Writing (2)
 - Graphic Arts in the Federal Government (4)
 - Graphic Methods of Presenting Statistics (2)
 - Indexing (2)
 - Introduction to Bibliographic Science (2)
 - Maps and Charts (2)
 - Official Writing (2)
 - Technical Writing (2)

Other courses may be approved depending upon the needs of the student.

- c. Subject-Matter Electives: Remaining hours of credit in subject-matter courses as recommended by the student's employer or as chosen by the student. May be selected from the Editing Electives listed above if appropriate to the position for which the student is preparing. This requirement can be waived for students who have college work or acceptable experience in a subject-matter field.

A student seeking this certified statement should consult with the Registrar and obtain approval of his proposed course of study early in his academic program. Equivalent courses will be accepted by transfer from other institutions.

Information Methods

2-225. Principles of Editing and Their Application

Fall, 3 credits. Repeated in Spring

H. NELSON FITTON
PETER A. SMITH

Primarily survey course for those seeking information on editorial techniques involved in handling manuscripts after they leave the author and until issued in printed form. Discussion of fundamental principles of editing, including style (based on *Style Manual* of Government Printing Office), grammar, rhetoric, readability, organization, printing techniques, marking type, copyfitting, and proofreading; and considerations governing tables, charts, photographs, indexes, bibliographies, footnotes, and other parts of a publication. Opportunity to apply principles through practical work in editing. Good knowledge of grammar essential.

2-239. Intermediate Editing

Fall, 3 credits. Repeated in Spring

JEROME H. PERLMUTTER
MAY P. SHARP

Follows Principles of Editing and Their Application. Designed to give the student who is in or expecting to enter editorial work practical exercises and experiences in important editing situations. Emphasis on various types of manuscripts and reports that require the editor's attention. How-to-do-it aspect of editing, with step-by-step guidance in fundamentals. Basic editorial terminology and shortcuts to more effective editing. Case histories in publications problems. Slides, motion pictures, and other visuals used. Class workshops to assist the student in applying editorial techniques to manuscripts. *Prerequisite:* Principles of Editing and Their Application, or working editor.

2-360. Advanced Practice in Editing

Spring, 3 credits

GENIANA R. EDWARDS

Advanced instruction in literary and statistical editing and integration of graphics. Editing of practice manuscript, requiring reorganization, extensive editing, and uniform styling. Preparation of manuscript for printer and proofreading. Comparison of several Government agency styles for citations, tables, graphics, and other details. Adaptation of style to meet special requirements under rules of Government Printing Office. Administrative control of manuscript and proof in editorial offices. *Prerequisite:* Principles of Editing and Their Application, or equivalent.

2-412. Editing Technical Manuscripts

Fall, 2 credits

JAMES E. REYNOLDS

Role of editor, including necessary qualifications, human relations aspect, relative responsibilities of editor and author, and ethical and practical basis for editing. Editorial evaluation of technical manuscripts, including organization of functional parts, sound procedural reasoning, correlation with technical work, style requirements, critical review, and preparation for reproduction. *Prerequisite:* Principles of Editing and Their Application, or B.A. in journalism or English, or two years experience in editorial environment.

2-415. Producing Popular Publication

Fall, 2 credits

DENNIS S. FELDMAN

Between the final editing and the time a pamphlet, brochure, or periodical comes off the press lies a multitude of details designed to enhance the appeal of the publication. The picture editor who lends his talents to make a publication come alive; the artist and layout man who create visual appeal; the caption writer—all these key personnel bring their specialized skills to bear. Examination of these fields by means of lecture and workshop. Techniques of preparing a manuscript for mass as well as for specialized audiences. Emphasis on the use of techniques that combine appeal with readability through extensive use of graphic materials. Review of production of low-budget publications. Students may bring to class problems or materials on which they are currently working. *Prerequisite:* Principles of Editing and Their Application, or equivalent.

2-220. Indexing

Fall, 2 credits

KATHERINE B. KELLY

Indexing primarily for periodicals, bulletins, reports, and books. Emphasis on general procedures and matters of policy as well as on basic principles and techniques. Specific types of indexing adapted to various subjects and popular style, contrasted with technical and scientific styles. Examples of different kinds of indexes. Practical work in preparation of indexes, including making of cross references, alphabetizing, and editorial preparation of index cards and manuscripts for printer. Knowledge of library or editorial work desirable.

2-152. Documentation

(See P. 33)

2-237. Printing, Layout, and Design

Fall, 2 credits. Repeated in Spring

BEN MUROW and ASSOCIATES

Designed for those who plan, prepare, or procure printing, duplicating, distribution of books, pamphlets, folders, posters, charts, forms, and other printed or duplicated matter. Printing processes and printing media. Composition. Book binding. Typography and design. Printing types. Illustrations, including photo-engraving process and photographs. Printing design, rough layouts, finished layouts, and methods of copy fitting. Printing for the Government, including agency responsibility, Government Printing Office responsibility, and agency procedure for procuring printing. Other printing media, including silk screen, ozalid, varitype, cold-type processes, and others. Regulations and specifications of the Joint Committee on Printing, Government Printing Office paper catalog, *Style Manual*, printing, and binding regulations.

2-243. Design in Visual Communication

Fall, 2 credits. Repeated in Spring and Summer

DAVID M. GRANAHAN

Designed to assist artists, art designers, visual information specialists, teachers, speakers, writers, and others having responsibility of developing and presenting visual programs. Emphasis on creativity involved in design, production, and use of visual aids. Analysis of relationship of visual communication to contemporary life. Demonstration of examples of current European adaptations.

2-273. Writing for Audio-Visual Communications

Fall, 2 credits

THEODORE R. HARRIS

Designed to acquaint those in information activities with writing and reviewing effective scripts for production of slide shows, radio and television spots, and motion pictures. Analysis of components for audio-visual communications techniques and audiences, using samples of successful campaigns.

2-276. Documentary and Instructional Film and Television

Spring, 2 credits

THEODORE R. HARRIS

History, development, growth, and use of this now widely-used tool for information, education, training, and reporting. Heavily documented with United States Government films and some foreign government film examples.

Library Technician Program

Library technicians are generally involved in sub-professional work under the guidance of the professional library staff. Such work requires a practical knowledge of library functions and services. The ability to apply standard library tools, methods, and procedures to the service needs of a particular library is essential.

The U. S. Civil Service Commission has established position-classification standards based on experience and training for supporting service personnel known as the Library Technician Series 1411. Under this separate career ladder, sub-professional staff in Federal libraries can advance from the GS-4 to the GS-9 levels or higher in some instances. More than 1,000 library technicians are employed currently by the Government, and opportunity exists for many more technicians in other libraries throughout the nation.

The courses offered in this program are non-professional library courses designed particularly with the needs of the library technician in mind. They acquaint the present or prospective technician with a general background of various library activities and a body of factual information on techniques.

A Certified Statement of Accomplishment is granted to a student who has completed an organized course of study intended to provide basic training in this area.

Requirements:

1. Graduation from high school, or the equivalent, is the minimal educational background required. An applicant for the Certified Statement must file a transcript of his high school or college record before completion of his Certified Statement program.

2. Demonstrated facility in English grammar and composition. This requirement can be met by successful completion of written assignments given as part of the course, Introductory Course for Library Technicians, which is prerequisite for all courses in the program.

3. 20 semester hours of credit with an average grade of B or better in the following courses:

a. Required courses: (15 credits)

Introductory Course for Library Technicians (2)
Introduction to Cataloging and Classification (2)
Cataloging and Classification II (2)
Principles of Library Organization (2)
Basic Reference Service and Reference Tools (2)
Introduction to Bibliographic Science (2)
Library Technician Seminar (3)

b. Electives: (5 credits)

Administrative Procedure (2)
A Foreign Language
Automation of Library Operations (2)
Basic Concepts of Data Processing (3)
Children's Books (2)
Documentation (2)
Indexing (2)
Information Storage and Retrieval by Computer (3)
Law Librarianship (2)
Maps and Charts (2)
Medical Terms Simplified (2)
Official Writing (2)
Principles of Editing and Their Application (3)

Other courses may be approved depending upon the needs of the student.

A student seeking this certificate should consult with the Registrar and obtain approval of his proposed course of study early in his academic program. Equivalent courses will be accepted by transfer from other institutions.

2-125. Introductory Course for Library Technicians

Fall, 2 credits. Repeated in Spring

LEILA P. MORAN

Basic course for those expecting to pursue organized study program leading to non-professional Certified Statement of Accomplishment. Outlines purposes, procedures, techniques, and trends of library service. Written assignments, based on individual reading and study, test and improve facility of the student in English grammar and composition.

2-135. Introduction to Cataloging and Classification

Fall, 2 credits

ROBERT L. BIRCH

JANE E. BRAUCHER

Organization of library material. Card catalog and auxiliary records. Cataloging rules and routines. Review of cataloging systems. Classification routines and review of classification systems.

2-139. Cataloging and Classification II

Spring, 2 credits

JANE E. BRAUCHER

JOSEPH R. JUDY

Discussion of more difficult problems in descriptive cataloging, classification, and subject headings. Cataloging of practice collection. *Prerequisite:* Introduction to Cataloging and Classification, or one year's library experience.

2-137. Basic Reference Service and Reference Tools

Fall, 2 credits. Repeated in Summer

ROBERT L. BIRCH

Designed to help the student learn how and when to use large number of important or typical reference books or sets of books, such as dictionaries, encyclopedias, indexes, atlases, and yearbooks.

2-138. Introduction to Bibliographic Science

Fall, 2 credits

LESLIE A. KULP

Bibliographic science and bibliographic style for beginners. Variations and forms of bibliography. Study and comparison of general bibliographic tools and indexes of chief importance.

2-136. Principles of Library Organization

Spring, 2 credits

PATRICK J. LARKIN

System and function of a library based on component parts and services that obtain regardless of size or purpose. Organization of function and service for utmost efficiency.

2-145. Law Librarianship

Spring, 2 credits

JACK S. ELLENBERGER

MARLENE C. MCGUIRL

Survey of law library administration with emphasis on research methods in primary and secondary authorities, international law, government publications, and work with Federal legislation. *Prerequisite:* Training in law or library work, or equivalent experience.

2-114. Maps and Charts (1970-71 and alternate years)

Fall, 2 credits

CATHERINE I. BAHN

Survey to give analyst, researcher, librarian or teacher working with maps understanding of both domestic and foreign maps and charts, the agencies that produce them, their catalogs and indexes, and their availability in map libraries. Study of United States, foreign, and international mapping activities on workshop basis to permit presentation and solution of individual problems. Pertinent information on map libraries, reference facilities, map acquisition, cataloguing and processing procedures and techniques. Presentation of maps, charts, reference materials, aids, and tools for laboratory use.

2-153. Automation of Library Operations

Fall, 2 credits

ABRAHAM I. LEBOWITZ

Introduction to automatic data processing as applied to solution of library problems. Description and explanation of necessary equipment. Methods for studying feasibility of ADP solutions to library problems, with illustrations from all aspects of library work. Description in detail of successful systems.

2-152. Documentation

Spring, 2 credits

ABRAHAM I. LEBOWITZ

Introductory survey designed to acquaint the student with many general topics involved in locating, organizing, and communicating specialized knowledge. Use of non-conventional systems in libraries and other information services.

4-106. Information Storage and Retrieval by Computer (See P. 58)

2-160. Library Technican Seminar

Fall, 3 credits. Repeated in Spring

JOHN SHERROD

Overall summary and review of practical problems in library operations. Emphasis on work with the individual student. Special readings in literature of librarianship. Open only to the student who has completed all other requirements for a Certified Statement of Accomplishment for Library Technicians, including B average in all courses taken.

Speech

2-228. Public Speaking for Beginners

Fall, 2 credits. Repeated in Spring

NORMA RENO MILLER

For those needing more self-confidence and ability in meeting business, club, church, and social speaking situations. Basic steps in speech preparation and delivery. Emphasis on extemporaneous speech of from one to 10 minutes in length. Twelve or more opportunities for each student to speak and receive written and oral constructive criticism.

2-229. Advanced Public Speaking

Fall, 2 credits. Repeated in Spring

ROBERT C. DONAHUE

Emphasis on gathering of materials, organization of speech, and repeated practice in delivery of various forms of public address. Wide application of audio-visual in various speech situations. Each student speaks at each meeting. Importance of personal recapitulation and student criticism. Instructor evaluation stressed. *Prerequisite*: Public Speaking for Beginners, or special permission.

2-232. Voice and Remedial Speech

Fall, 2 credits

NORMAN S. BARNES

Drill course. Word analysis. Consonant clarity. Phrasing. Pausing. Pronunciation. Voice: power, pitch, inflection, quality, vitality, and stress. Reading from manuscript.

2-246. Voice and Diction

Spring, 2 credits

JOHN C. BAKER

Fundamentals as outlined in course description for Voice and Remedial Speech form basis of course. More advanced work presented. May be continuation of Voice and Remedial Speech for the student needing two courses in this area.

2-236. Remedial Speech

Summer, 2 credits

NORMAN S. BARNES

Techniques to aid in the correction of specific speech problems. Practice course. Individual guidance.

Foreign Languages

The Graduate School provides opportunities for instruction in a wide range of foreign languages. The courses presently available are listed on the following pages. Additional courses in these and other languages can be offered if there is sufficient demand. Students with special interests should consult the Registrar well in advance of the opening of a semester.

2-209. Introduction to Linguistics

Year, 3 credits each semester

WILLIAM H. THOMPSON

Basic facets and fundamentals of linguistics accepted by majority of scholars in order to serve as basis for understanding of nature and functioning of language. First step toward study of advanced linguistics. Featuring of no specific language structure. Rather presentation of broad spectrum linguistic phenomena in traditional sequence of phonetics, phonemics, morphology, and syntax. Linguistic geography, graphemics, linguistic changes, related fields, and uses of linguistics. *Prerequisite*: One year of foreign language at college level, or equivalent.

2-219. Principles of Translation

Fall, 3 credits. Repeated in Spring

GERARD L. LA ROCHE

Demonstration of principles and techniques of translation through comparative analysis of structural and stylistic elements of French and English. Two-way translation by way of illustration. Development of practical skill principally through translation of general French language texts into closest stylistic English equivalent. Brief review of finer points of French grammar. *Prerequisites*: Intermediate knowledge of French and demonstrated ability to write lucid English prose.

Chinese

[2-200.] Elementary Mandarin Chinese (1971-72 and alternate years)

Year, 4 credits each semester

MARGARET T. HU

Introductory course in written Mandarin Chinese.

2-201. Intermediate Mandarin Chinese (1970-71 and every third year)

Year, 4 credits each semester

MARGARET T. HU

Intermediate course in written Mandarin Chinese.

[2-202.] Advanced Mandarin Chinese (1972-73 and every third year)

Year, 3 credits each semester

MARGARET T. HU

Advanced course in written Mandarin Chinese.

French

2-253. Elementary French

Year, 3 credits each semester

GERMAINE BARGIN
HENRIËTTE DE CONSTANT CHARDON
HÉLÈNE VERNIER THATCHER

Basic grammar and vocabulary. Foundation work in speaking, understanding, reading, and writing French. For beginners.

2-254. Intermediate French

Year, 3 credits each semester

GERMAINE BARGIN
HENRIËTTE DE CONSTANT CHARDON
HÉLÈNE VERNIER THATCHER

Sequel to Elementary French. Systematic review of French grammar. Continued training in speaking, understanding, reading, and writing French. *Prerequisite*: One year of French at college level, or equivalent.

2-68. Reading French

Fall, non-credit. Repeated in Spring and Summer

HENRIËTTE DE CONSTANT CHARDON

Basic French grammar, reading, and vocabulary building for students who have had some French and wish to review it.

2-87. Basic Conversational French

Fall, non-credit. Repeated in Spring and Summer

GERMAINE BARGIN

Designed to impart elementary facility in everyday spoken French. Through practice, the student learns to make himself understood and to follow conversations about family, meals, work, sports, travelling, and other common subjects. Useful for those planning to travel in a French-speaking country. No previous knowledge of French required.

2-255. Advanced French Conversation and Composition

Fall, 3 credits. Repeated in Spring

HÉLÈNE VERNIER THATCHER

Designed to develop fluent style of idiomatic conversation on topics most likely to be met in travelling in French-speaking countries. Grammar review. Some composition and dictation exercises. Reading of classical and current French authors. *Prerequisite*: Three years of college French, or equivalent. Good knowledge of grammar and considerable vocabulary.

2-258. Advanced French Reading

Fall, 3 credits. Repeated in Spring

HENRIËTTE DE CONSTANT CHARDON

Reading and translation of more advanced French texts. Emphasis on correct pronunciation and reading. *Prerequisite*: Two years of college French, or equivalent.

2-274. Advanced Reading and Conversation

Fall, 3 credits. Repeated in Spring

HENRIËTTE DE CONSTANT CHARDON

Designed to assist the student to attain advanced level of reading and comprehension fluency. To encourage comparisons and analyses of literature studied in class conversation. Texts range through Pascal, Musset, Flaubert, Rimbaud, Valéry, and others. Grammar reviewed as required. Translations corrected and edited. Related cultural-historical discussions. *Prerequisite*: Three years of college French, or equivalent. Good reading comprehension.

2-284. French Contemporary Life

Fall, 3 credits. Repeated in Spring

GENEVIEVE M. D'HAUCOURT

Basic data of French civilization: Geographical features, racial components, and others. Historical developments resulting in present-day French. Its features and problems. Survey of economic, political, and social conditions as of present, future trends. Course given in French or English, depending on needs of the students.

German

2-259. Elementary German

Year, 3 credits each semester

REINHOLD W. HOFFMANN

Basic grammar and vocabulary. Foundation work in speaking, understanding, reading, and writing German. For beginners.

2-260. Intermediate German

Year, 3 credits each semester

LOUCIANA G. M. ROSE

Sequel to Elementary German. Systematic review of German grammar. Continued training in speaking, understanding, reading, and writing German. Brief introduction to German literature, civilization, and thought, based on selected intermediate level readings. *Prerequisite*: One year of German at college level, or equivalent.

2-88. Basic Conversational German I

Fall, non-credit. Repeated in Spring and Summer

CHARLES V. P. VON LUTTICHAU

Designed to impart elementary facility in everyday spoken German. Through practice, the student learns to make himself understood and to follow conversations about family, meals, work, sports, travelling, and other common subjects. Useful for those planning to travel in a German-speaking country. No previous knowledge of German required.

2-96. Basic Conversational German II

Spring, non-credit

CHARLES V. P. VON LUTTICHAU

Continuation of Basic Conversational German. Practice in conversation to improve vocabulary and fluency. *Prerequisite*: Basic Conversational German I, or equivalent.

2-196. Scientific German I

Fall, 3 credits. Repeated in Spring and Summer

ERIKA R. NEIL

Basic grammar with emphasis on scientific vocabulary. For the scientist or student preparing for language examinations required for advanced degrees. No previous knowledge of German required.

2-197. Scientific German II

Fall, 3 credits. Repeated in Spring

ERIKA R. NEIL

Designed to develop reading knowledge of scientific German. *Prerequisite*: Scientific German I, or equivalent.

Italian

2-270. Elementary Italian

Year, 3 credits each semester

MAGNA E. BAUER

Basic grammar and vocabulary. Foundation work in speaking, understanding, reading, and writing Italian. For beginners.

2-271. Intermediate Italian

Year, 3 credits each semester

VICTOR L. BONDI

Sequel to Elementary Italian. Systematic review of Italian grammar. Continued training in speaking, understanding, reading, and writing Italian. *Prerequisite*: One year of Italian at college level, or equivalent.

Portuguese

[2-290.] Elementary Portuguese (1971-72 and alternate years)

Year, 3 credits each semester

ADALCINDA C. LUXARDO

Basic grammar and vocabulary. Foundation work in speaking, understanding, reading, and writing Portuguese.

2-291. Intermediate Portuguese (1970-71 and alternate years)

Year, 3 credits each semester

ADALCINDA C. LUXARDO

Sequel to Elementary Portuguese. Systematic review of Portuguese grammar. Continued training in speaking, understanding, reading, and writing Portuguese. *Prerequisite*: One year of Portuguese at college level, or equivalent.

Russian

2-295. Elementary Russian

Year, 3 credits

VICTOR A. FEDIAY
LIDIA GERICH
NICHOLAS RICHTER

Basic grammar and vocabulary. Foundation work in speaking, understanding, reading, and writing Russian. For beginners.

2-296. Intermediate Russian

Year, 3 credits each semester

VICTOR FEDIAY
LIDIA GERICH
NICHOLAS RICHTER

Sequel to Elementary Russian. Systematic review of Russian grammar. Continued training in speaking, understanding, reading, and writing Russian. *Prerequisite*: One year of Russian at college level, or equivalent.

2-299. Advanced Russian

Year, 3 credits each semester

VICTOR FEDIAY
LIDIA GERICH
NICHOLAS RICHTER

Reading and translation of more advanced Russian texts. Composition in Russian. Oral and written translation from English to Russian. *Prerequisite*: Two years of Russian at college level, or equivalent.

2-292. Scientific Russian I

Fall, 3 credits

TATIANA W. BOLDYREFF

Designed to develop reading knowledge of scientific Russian. No previous knowledge of Russian required.

2-294. Scientific Russian II

Spring, 3 credits

TATIANA W. BOLDYREFF

Designed to develop reading knowledge of scientific Russian. *Prerequisite:* Scientific Russian I, or equivalent.

2-31. Russian Poetry

Fall, non-credit. Repeated in Spring

TATIANA W. BOLDYREFF

Readings in Russian poetry from beginning to present, including modern living poets, but with emphasis on classical poets, especially Lermontov and Pushkin. Interpretation and appreciation of form and content. Informal discussion encouraging active student participation. Lectures, readings, translations, and recitations. Term paper optional. *Prerequisite:* Two years of college Russian, or equivalent.

Spanish

2-300. Elementary Spanish

Year, 3 credits each semester

ERWIN JAFFE
JOSÉ OTERO

Basic grammar and vocabulary. Foundation work in speaking, understanding, reading, and writing Spanish. For beginners.

2-301. Intermediate Spanish

Year, 3 credits each semester

MARIA Z. BROUWER

Sequel to Elementary Spanish. Systematic review of Spanish grammar. Continued training in speaking, understanding, reading, and writing Spanish. *Prerequisite:* One year of Spanish at college level, or equivalent.

2-302. Advanced Spanish Conversation and Composition

Year, 2 credits each semester

ANTONIO LASAGA

Designed to develop fluency in idiomatic conversation and to provide thorough training in the structure of the language. Grammar review only if deemed necessary. Writing of compositions commercial and familiar letters. Reading of current newspapers, magazines, and novels. *Prerequisite:* Intermediate Spanish, or equivalent.

2-83. Basic Conversational Spanish I

Fall, non-credit. Repeated in Spring and Summer

ANTONIO LASAGA
JOSÉ OTERO

Designed to impart elementary facility in everyday spoken Spanish. Through practice, the student learns to make himself understood and to follow conversations about family, meals, work, sports, travelling, and other common subjects. Useful for those planning to travel in a Spanish-speaking country. No previous knowledge of Spanish required.

2-84. Basic Conversational Spanish II

Fall, non-credit. Repeated in Spring and Summer

José Otero

Continuation of Basic Conversational Spanish. Continued practice in conversation to improve vocabulary and fluency. *Prerequisite*: Basic Conversational Spanish, or equivalent.

Swahili

2-210. Elementary Swahili

Year, 3 credits each semester

MILAN G. P. DE LANY

Study of sound system and basic structure of Swahili language. The students learn to take part in simple conversation, as well as to read and write.

2-211. Intermediate Swahili

Year, 3 credits each semester

MILAN G. P. DE LANY

Sequel to Elementary Swahili. Systematic review of grammar, including more advanced structures and idioms. Continued training in speaking, comprehension, reading, and writing. *Prerequisite*: Elementary Swahili, or equivalent.

Mathematics and Statistics

DEPARTMENTAL COMMITTEE

Bruce W. Kelly, *Chairman*

Maurice F. Bresnahan, Morris H. Hansen, Earl E. Houseman, Raymond J. Long,
Margaret E. Martin, Jack Moshman, Vito Natrello, Walt R. Simmons, B. Ralph Stauber,
Benjamin J. Tepping, Marie D. Wann

Unprecedented dependence is being placed on statisticians by administrative officials in Government and in private business all over the world. The statistician, through his specialized training, is able to provide current and comprehensive information as well as specialized judgment on many subjects, and to do so with speed and economy. By applying proper principles of design, he can insure securing the maximum amount of information from a given investment in an experiment or survey. His specialized knowledge and techniques are indispensable in both industry and in Government.

The making of a statistician is a long and exacting process. Several years of graduate study, and at least a year and a half of high-level experience under competent leadership are essential. Educational facilities are strained, not only because of the heavy and increasing demand, but also because the educational requirements placed on the statistician today are of an entirely different order of magnitude than only a few years ago.

Recent years have seen the addition of an array of computing aids that vastly expand the horizon of what is possible in statistical data handling and computation. Computational and data handling operations that were regarded as impossible or even fantastic a few years ago are now routine as a result of the development of the electronic computer. This means that the statistician must be familiar not only with the theoretical principles underlying statistical analysis and the design of surveys and experiments, together with the skills for carrying out the operational phases of such activities. He must also be familiar with the potentialities and application of modern-day equipment for carrying out the computational aspects of his activities.

Accordingly, the courses offered by the Department of Mathematics and Statistics include: Basic mathematics prerequisite to statistics courses, specialized mathematics related to statistics, a wide range of courses in statistics ranging from elementary to advanced, data processing on electronic computers, and supplementary subjects related to the statistical field.

Mathematics

3-8. Intermediate Algebra

Fall, non-credit. Repeated in Spring and Summer.

REX G. BUTLER
STEWART B. FOX, JR.

Designed primarily for the student with limited background in algebra, or who has been away from algebra for a number of years and needs a refresher course. Fundamental operations of addition, subtraction, multiplication, and division. Factoring. Fractions. Linear equations in one, two,

and three unknowns. Functions and their graphs. Systems of linear equations. Exponents and radicals. Quadratic equations. Ratio, proportion, and variation. Arithmetic and geometric progressions. Logarithms. Binomial theorem. Considerable effort required for the student with no more than high school algebra.

3-30. Basic Mathematics

Fall, non-credit. Repeated in Spring

LEONIDE STAMBUL-SHEIK

Review of arithmetic with applications. Fundamental operations in algebra. Equations and formulas. Graphic representation. Ratio. Proportions. Progressions. Number series. Permutations. Logarithms. Slide rule. Geometric formulas and their application. Trigonometric definitions and functions. Solving of triangles. Applied mathematics in theory and practice. *Prerequisite*: High school algebra.

3-1. Review of College Freshman Mathematics

Year, non-credit

ANTHONY T. DIAMOND

Review at level of college Freshman mathematics. Algebra, trigonometry, and analytic geometry. Brief introduction to methods of the differential calculus. Emphasis on applications to statistical problems. *Prerequisite*: One year of college mathematics.

3-2. Review of Calculus

Spring, non-credit. Repeated in Summer

HARRY A. COLE, JR.

WILLIAM I. MILWEE, JR.

Variables, functions, limits, derivatives, application of derivatives to geometry as well as engineering curve fitting and analysis. Transcendental functions, parametric equations, solar equations, differentials, mean value theorem, techniques of integration, and engineering application. Series and expansion of functions. Hyperbolic functions, differential equations, and partial equations. *Prerequisites*: Analytic geometry and differential and integral calculus.

3-102. College Algebra

Fall, 4 credits. Repeated in Spring

NATHAN GORDON

NATHAN LACHER

Number system of algebra. Algebraic expressions. Elementary graphical methods. Operations with polynomials. Fractional expressions. Linear equations. Fractional exponents. Radicals and complex numbers. Quadratic equations. Systems of equations in two unknowns involving quadratics. Ratio, proportion, and variation. Theory of equations. Determinants. Solution of equations by inverse matrix. Permutations, combinations, and probability. Binomial theorem. Progressions. Infinite geometric series. Inequalities. Logarithms. Mathematics of investment. *Prerequisites*: Elementary and Intermediate Algebra and plane geometry.

3-103. Trigonometry and Analytic Geometry

Fall, 4 credits. Repeated in Spring

THOMAS A. BENEDIK

JAMES G. HOWCROFT

Basic definitions and uses of trigonometric functions. Logarithmic solutions of triangles. Radian measure. Fundamental identities. Oblique triangles. Polar coordinates and inverse trigonometric functions. Complete numbers and De Moivre's theorem. Graphs of functions and inverse functions. Fundamental definitions and theorems of analytic geometry. Loci. Line. Parallelism and perpendicularity. Transformation of coordinates. Circle and conic sections. *Prerequisite*: College Algebra.

3-104. Trigonometry

Summer, 2 credits

JOSEPH L. STEARN

Basic definitions and uses of trigonometric functions. Logarithmic solutions. Radian measure. Fundamental identities. Oblique triangles. Polar coordinates. Inverse trigonometric functions. Complex numbers and De Moivre's theorem. Graphs of functions and inverse functions. Introduction to spherical trigonometry. *Prerequisite*: College algebra.

3-206. Calculus

Year, 4 credits each semester

HARRY A. COLE, JR.
EUGENE B. MITCHELL
CHARLES E. SLONIM
GORDON F. SPOONER

First semester: Variables, functions, limits, continuity, derivatives. Applications of the derivative to geometry and physics. Maxima and minima. Differentials. Mean value theorem. Simple integration and applications to geometry and physics. Radius and circle of curvature. Vectors. Hyperbolic functions. Partial derivatives. Second semester: Standard integral forms. Special methods of integration. Approximate methods of integration. Improper integrals. Indeterminate forms. Series. Expansion of functions. Multiple integrals. Introduction to differential equations. *Prerequisites*: College algebra, trigonometry, and analytic geometry.

3-415. Elementary Matrix Theory

Year, 3 credits each semester

MICHAEL C. DAVIS
LAWRENCE A. GAMBINO
WESLEY E. SANBURN

Matrix algebra. Determinant theory. Inverse of matrix, rank, and equivalence. Linear equations and linear dependence. Vector spaces and linear transformations. Characteristic equation of matrix. Bilinear and quadratic forms. *Prerequisite*: One year of college mathematics, or equivalent.

3-444. Elements of Abstract Algebra

Fall, 3 credits. Repeated in Spring

WESLEY E. SANBURN

Algebraic systems. Integers, sets, ordering, equivalence relations, mathematical induction, mappings, and binary operations. Sets with one binary operation—groups. Sets with two binary operations—rings, integral domains, and fields. Vector spaces and linear transformations. Boolean algebras. *Prerequisite*: One semester of matrix algebra, or equivalent.

3-502. Differential Equations

Year, 3 credits each semester

EDWARD J. MCGRANE

Basic theory of differential equations. Techniques for solving various types of differential equations to include first order and higher and first degree and higher. Linear differential equations with constant coefficients and application. Use of symbolic operators and inverse transforms. Laplace transforms. Fourier transforms, partial differential equations, and their application. Review of calculus as required. Physical and engineering (mechanical and electrical) applications of differential equations stressed. *Prerequisites*: Thorough understanding of algebra, analytical geometry, trigonometry, and differential and integral calculus.

3-500. Topics in Higher Applied Mathematics

Year, 3 credits each semester

GEORGE P. NEYMAN, III

First semester: Covers some principal analytical tools of science and engineering. Typical applications discussed throughout course. Differential and integral applications of functions of several variables. Infinite series and power series expansions. Gamma, Beta, and Bessel functions. Fourier series and integral. Fundamental operations with vectors, linear vector spaces, and introduction to vector field theory including line and surface integrals. Second semester: Dimensional

analysis. Complex variables: Analytic functions, integrals, power series, residues, and conformal mapping. Laplace and related transforms. Stieltjes integrals. *Prerequisites*: Differential and integral calculus.

3-310. Introduction to Probability Theory

Year, 3 credits each semester

MORTON S. RAFF

Designed for research workers wanting introduction to probability theory and its application to statistical technique. Historical development of various definitions and philosophic points of view of probability and their practical implications for subject-matter application. Elementary theory of sets, combinatorial analysis, conditional probability and Bayes's Rule, discrete and continuous distribution functions, and random variables. Sums of random variables, variance of sums, generating functions, testing of hypotheses, and estimation of parameters. *Prerequisite*: One year of calculus

3-312. Numerical Methods in Computation

Year, 2 credits each semester

L. KENTON MEALS

Designed as introduction to major topics in numerical mathematical analysis used in modern scientific digital computation. Broad coverage of types of mathematical problems solvable on digital computers. Their reduction to efficient digital computer procedures, including flow-charting. Measurement and control of numerical errors encountered in computing. First semester: General concepts of digital computation. Theory and practice of flow-charting. Types of computational errors, ways of representing them, and evaluating their effects. Approximation of functions by series. Iterative methods of solution of algebraic and transcendental equations. Computation of determinants and inversion of matrices. Solution of systems of linear equations. Second semester: Interpolation methods for one and two independent variables. Methods of Lagrange and Bernstein. Characteristic values and vectors. Formulas for numerical differentiation and integration. Solution and systems of differential equations. Linear differential equations. *Prerequisites*: Analytic geometry and basics of differential and integral calculus. Programming experience desirable. The second semester may be taken without the first, with special permission.

3-599. Numerical Methods for Scientists and Engineers

Fall, 3 credits

S. RICHARD KRAFT

Survey of general methods of numerically solving differential equations. Study of basic types of equations by process beginning with derivation of equation from fundamental physical principles and ending with numerical solution on digital computer. Stress on learning numerical algorithms for solving equations and learning techniques for investigating accuracy, stability, and convergence rate of algorithm. *Prerequisites*: Thorough understanding of calculus and familiarity with matrices and digital computers.

3-315. Introduction to Modern Mathematics

Fall, 3 credits. Repeated in Spring and Summer

JOHN H. AWL

Modern approach to basic ideas of mathematics. Finite situations and logical relations as basis for introduction to and consideration of sets and subsets, probability, statistics, vectors and matrices, and game theory. *Prerequisite*: College algebra, or special permission.

3-546. Application of Differential Equations to Engineering Theory and Related Problems including Wave Theory

Year, 3 credits each semester

EDWARD J. McGRANE

Development and application of operational methods and techniques to engineering subjects and related problems. Mathematical analysis of engineering systems, employing such techniques as further development and application of Laplace and Fourier transforms to linear and non-linear systems, use of series, approximation to second order differential equations, and partial differential equations. Stability theory. System responses. Oscillatory functions and network analysis. Wave theory and propagation of electro-magnetic energy through various media. Use of vector and vector analysis. Development of principles of transmission lines. Development of Maxwell's equations. *Prerequisite*: Differential Equations, or equivalent.

3-508. Theory of Errors (1970-71 and alternate years)

Spring, 3 credits

JOSEPH L. STEARN

Basic concepts in theory of errors and their application to problems in engineering. Designed to give the student sufficient background to find solutions to problems in error theory and least squares. Classification of errors, the Gaussian law of error, normal distribution, rectangular distribution, measures of precision, propagation of errors, method of least squares as applied to observation and condition equations, design of significance tests for acceptance or rejection of observations, simultaneous solution of observation and condition equations, variance-covariance matrix, and alternatives to least squares. First three weeks devoted to introduction to basic fundamentals of matrix calculus. *Prerequisite*: Calculus.

3-509. Mathematics for Economists

Year, 3 credits each semester

ANTHONY S. ROJKO

Aspects of mathematics most useful to economists: Algebra, geometry, differential and integral calculus, differential and difference equations, and matrix algebra. At each stage, use of described mathematical methods to solve problems based on economic theory or analysis. Demonstration of applications of these techniques in fitting equations by least squares, in fitting systems of simultaneous equations, and in using such systems for analytical purposes. *Prerequisites*: Principles of Economics and college algebra, or special permission.

8-406. Engineering Mathematics

(See P. 111)

3-532. Introduction to Linear Programming

Fall, 3 credits

W. CHARLES MYLANDER

Basic theoretical, computational, and applied aspects of linear programming. Background for recognition of problems of linear programming nature, formulation of such problems as linear programming models, and use of proper computational techniques to solve these problems. Understanding of mathematical aspects tying together these elements of linear programming. General linear programming problem, simplex computational procedure, duality theorems of linear programming, transportation problem, assignment problems, production scheduling problems, diet problems, additional applications, relationship between the zero-sum two-person game and linear programming, parametric linear programming, and recent developments. Introductory lectures on matrices, vectors and vector spaces, convex sets, and linear inequalities. *Prerequisite*: Two years of college mathematics.

3-541. Mathematical Programming

Spring, 3 credits

W. CHARLES MYLANDER

Basic concepts and methods of mathematical programming. Minimization of function of many variables subject to system of linear and non-linear inequality constraints. Theory of convex sets and functions. Minimax and duality theory. Necessary and sufficient conditions for optima of non-linear programming. Methods for solving non-linear programming problem such as feasible directions, cutting planes, penalty functions, and pivot algorithms for quadratic programming. Advanced topics in linear programming. *Prerequisite*: Introduction to Linear Programming, or one semester of undergraduate real analysis.

3-533. Mathematical Methods in Operations Research I

Fall, 3 credits

LEON H. MILLER, JR.
LOUIS Y. POULIQUEN

Study of methods and philosophies used in operations research and systems analysis. Methods used in solving deterministic models of business military, and government. Optimization methods of single and multiple variables, non-linear programming, linear programming, dynamic programming, PERT, and inventory theory. Application and computational aspects stressed. *Prerequisite*: Calculus.

3-534. Mathematical Methods in Operations Research II

Spring, 3 credits

LEON H. MILLER, JR.

Study of stochastic models as used in business, military, and government. Queueing theory, Markov chains, simulation, decision theory, management games, and theory of games. *Prerequisites:* Calculus and one year of statistics. *Operations Research I is not required.*

Statistics

Certified Statement of Accomplishment in Statistics

A Certified Statement of Accomplishment in Statistics is granted to a student who has completed an organized program in one of three fields of statistical study, the social sciences, the natural sciences, or mathematical statistics. These represent areas of statistical preparation and application especially useful in the Federal Government. Completion of one of these programs prepares the student for effective public service in a particular field. Substitutions may be approved under appropriate circumstances.

Requirements

1. An undergraduate degree
2. Basic courses required of all candidates: (15 credits) (for all fields)
 - College Algebra (4)
 - Plane Trigonometry (2)
 - Analytic Geometry (2)
 - Calculus (4)
 - Principles of Statistical Analysis (3) or Elements of Statistical Methods (2)
3. 24 semester hours of credit with an average grade of B or better in the following specialized and elective courses:
 - a. Specialized Courses:
 - Social Sciences
 - Mathematical Statistics (8)
 - Elementary Matrix Theory (6)
 - Sampling in Social and Economic Surveys (3) or Theory of Sample Surveys (4)
 - Introduction to Population Statistics (3)
 - Natural Sciences
 - Mathematical Statistics (8)
 - Statistics in Experimental Research (3)
 - Elementary Matrix Theory (6)
 - Design of Experiments in Biological Sciences (4)
or Introduction to Experimental Statistics (8)
 - Application of Experimental Statistics to Biological Problems (6)
 - Mathematical Statistics
 - Mathematical Statistics (8)
 - Elementary Matrix Theory (6)
 - Theory of Sample Surveys (4)
 - Introduction to Probability Theory (6)
 - A course in programming an electronic digital computer

b. Elective Courses:

Differential Equations (4)

Intermediate Mathematical Statistics and Probability (6)

Introduction to Linear Programming (3)

Operations Research I and II (6)

Mathematical Programming (3)

Statistics in Experimental Research (3)

A student seeking this certified statement should consult with the Registrar and obtain approval of his proposed course of study early in his academic program. Equivalent courses will be accepted by transfer from other institutions.

3-6. Preparatory Mathematics for Introductory Statistics

Fall, non-credit. Repeated in Spring and Summer

WILLIAM E. KIBLER

For the student with inadequate mathematical background who desires to study statistics at introductory level. Basic operations of algebra, fractions, exponents, summation notation, manipulation of algebraic expression, graphic representation of equations, solution of simultaneous equations, elements of probability, and permutations and combinations. Emphasis on algebra used in statistics. Examples and problems primarily from statistical operations. *Prerequisite:* High school algebra.

3-126. Introductory Statistics

Year, 3 credits each semester. Repeated in Spring and Summer

JAMES M. CONDIE
DONALD J. GANTZER
GALEN F. HART
RICHARD S. MAGLEBY
FRANCIS S. URBAN
QUENTIN M. WEST

First semester: Collection of data. Classification and presentation of data in tabular and graphic forms. Measures of central tendency. Measures of dispersion and symmetry. Probability theory. Basic probability distributions. Sample distributions. Statistical estimation. Sample design. Second semester: Tests of hypotheses. Chi-square and other non-parametric methods. F distribution. Analysis of variance. Regression analysis. Simple and multiple correlation. Time series analysis. Index numbers. *Prerequisite:* High school algebra.

3-380. Principles of Statistical Analysis

Year, 3 credits each semester

CHARLES E. CAUDILL

Foundation for basic concepts and principles of statistical analysis, and development of understanding of their application to scientific investigation. Elementary probability. Expected values. Binomial, Poisson, and normal distributions. Introduction to sampling. Statistical tests of significance. Introduction to concept of maximum likelihood and to nonparametric tests. Simple and multiple correlation. Some theory of determinants with applications to correlation and the inverse matrix. Introduction to analysis of variance and covariance. Elementary principles of design and analysis of surveys and experiments. Use of statistical tables by Fisher, Yates, and others. *Prerequisites:* College Algebra. Elementary statistics, and/or further mathematics desirable.

3-385. Elements of Statistical Methods

Year, 2 credits each semester

JUDSON U. MCGUIRE, JR.
RUEL L. WILSON, JR.

Principles underlying statistical methods with particular reference to natural and physical sciences. Elementary probability, distribution of discontinuous and continuous variables, statistics versus parameters, chi-square test, "t" test, correlation, regression, analysis of variance and covariance, and meaning of experimental error and statistical inference. *Prerequisite:* College training in agriculture or biological sciences. College algebra helpful.

3-136. Graphic Methods of Presenting Statistics

Fall, 2 credits

JAMES R. VECHERY

Analysis of statistical data to determine best form for graphic presentation. Application of data to many types of illustrations in several forms of various classes. Preparation of rough pencil layout examples of time series charts, frequency diagrams, semilog charts, pie charts, pictorial symbol charts, cartograms, and other illustrative examples. Analysis of comparability and evaluation of individual charts and maps in series.

3-318. Machine Tabulation I

Fall, 2 credits. Repeated in Spring

S. EDWARD PELL

Principles of operation, capabilities, and limitations of electrical accounting machine equipment. Card punching and verifying machines. Sorters. Collators. Interpreters. Reproducing punches. Others. Instruction in basic wiring of machines. *Not intended to train in physical operation of machines.*

3-319. Machine Tabulation II

Spring, 2 credits

S. EDWARD PELL

Principles of operation, capabilities, and limitations of electrical accounting machines. Type 407. Instruction in wiring of machines including solution of advanced wiring problems. *Not intended to train in physical operation of machines. Prerequisite:* Machine Tabulation I, or knowledge of basic wiring of electronic accounting machine equipment.

3-400. Mathematical Statistics

Year, 3 credits each semester

BARBARA A. BAILAR and JOHN C. BAILAR, III

Theory of statistics with introduction to probability theory and statistical inference. Sample space, sets, and events. Axiomatic theory of probability. Marginal and conditional probability. Bayes' Theorem. Discrete and continuous probability functions. Expectation. Moments and moment generating functions. Hypergeometric, binomial, poisson, normal, gamma, and beta distributions. Sampling statistics. Limit theorems. Sampling distributions, Chi-square, Snedecor's F and student's t. Decision theory, estimation, properties of point estimators, Cramer-Rao inequality, maximum likelihood, confidence interval estimation, testing hypotheses, Neyman-Pearson principle, and likelihood ratio. Regression and linear hypotheses. Multivariate normal distribution. Order statistics. Applications in assigned problems reviewed in class. *Prerequisites:* Calculus and Introductory Statistics, or special permission.

3-404. Intermediate Mathematical Statistics and Probability (1970-71 and alternate years)

Year, 3 credits each semester

JOHN C. BAILAR, III

First semester: Foundations of probability theory. Moments and other characteristics of probability distributions. Characteristic functions. Limit theorems. Introduction to stochastic process. Second semester. Sample functions. Order statistics. Testing hypotheses. Estimation. Basic theory of sampling. *Prerequisites:* Calculus and Mathematical Statistics, or equivalent, or special permission.

[3-460.] Stochastic Processes (1971-72 and alternate years)

Year, 3 credits each semester

JOHN C. BAILAR, III

Statistical study of time series and other random processes, with applications in natural, social, and biological sciences. First semester: Properties of random processes. Statistical operations on processes. Study of counting processes. Second semester: Markov processes, including random walks, birth-and-death processes, queueing theory, detection of clustering, competition and predation, and diffusion processes. Emphasis on understanding concepts and theory as necessary step toward application. *Prerequisites:* Calculus and Introductory Statistics, or equivalent. Mathematical Statistics or probability desirable.

3-405. Statistics in Experimental Research

Fall, 3 credits

HAROLD F. HUDDLESTON

Design, analysis, and interpretation of data from experiments or surveys. Elementary probability relationships, concept of sampling error, determination of sample size, tests of hypotheses for two or more sample means, uses of chi-square, analysis of variance and covariance, and individual degrees of freedom. Basic design principles of completely randomized, randomized block, Latin square, split plot, incomplete blocks, factorials, and confounding. *Prerequisite*: Recent course in elementary statistical methods, or familiarity with ordinary methods of tabulating experimental data, or special permission.

3-435. Sampling in Social and Economic Surveys (1970-71 and alternate years)

Fall, 3 credits

HAROLD NISSELSON

Nonmathematical survey of sampling theory and practice. Development of basic ideas of statistical sampling, with applications in social and economic surveys. Unrestricted random, stratified, systematic, area and cluster sampling, and subsampling. Discussion of sample designs used in United States and in foreign countries with respect to considerations of statistical efficiency, cost functions, and the administrative limitations imposed on design. *Prerequisite*: Elementary statistics.

3-450. Introduction to Population Statistics

Fall, 3 credits

SAMUEL BAUM

Principal sources of population data. Collection and processing of demographic data. Problems of census taking. Measuring quality of population data. Basic methods of measuring and analyzing population size, geographic distribution, composition (age, sex, race, and ethnic composition) and dynamics (natality, mortality, reproductivity, and migration). Principal demographic rates, including crude and adjusted rates. General methods such as standardization, cohort analysis, and interpolation. Nature and use of life tables. Population estimates and projections. *Prerequisites*: Elementary statistics and course in social sciences.

1-570. Design of Experiments in Biological Sciences

(See P. 16)

6-415. Statistical Science in Management

(See P. 80)

6-343. Statistical Sampling for Financial Management

(See P. 91)

3-490. Application of Experimental Statistics to Biological Problems

Year, 3 credits each semester

RICHARD P. LEHMANN and ROBERT H. MILLER

First semester: Review of linear, multiple linear, curvilinear, and multiple curvilinear regression methods, with particular reference to biological research. Multiple regression approach to analysis of data from experimental designs. Analysis of nonorthogonal data and missing plot techniques. Second semester: Mixed and random models. Estimation of variance components by direct and indirect methods. Special topics: Individual regressions in least squares analysis. Indirect methods of estimating effects. Weighted least squares methods. Transformations. Maximum likelihood methods. Necessary basic matrix arithmetic as needed. *Prerequisites*: College algebra and course in experimental statistics.

3-735. Theory of Sample Surveys

Year, 2 credits each semester

JOSEPH STEINBERG and JOSEPH WAKSBERG

History of sampling in social surveys. Use of statistical control in improving quality and efficiency of estimates. Calculation of sampling errors. Random, stratified random, purposive, double and systematic sampling. Cost function and choice of sampling unit. Size and type of sample necessary to attain stated degree of precision. Distinction between precision and accuracy. Development of theory of probability as necessary. Contributions of Fisher, Neyman, Yates, Cochran, and others. *Prerequisites*: Calculus and Principles of Statistical Analysis.

3-763. Nonsampling Errors in Statistical Surveys

Fall, 2 credits

MONROE G. SIRKEN

Review of statistical concepts. Models used in design of statistical surveys. Distinction between mixed error and specific error models. Derivation of mixed error models. Models dealing with non-response and with memory bias. Application of error models in design of optimum statistical surveys.

3-762. Electronic Computer Methods for Statisticians

(See P. 54)

3-025. Federal Statistical Services

Fall, non-credit

PAUL F. KRUEGER

Federal statistical system: its growth, organization, major characteristics, and functions. Four lecture-seminars meeting from 3:30 to 5:00 P.M. on September 24, October 8, October 22, and November 5. Registration required, but no fees charged.

Electronic Data Processing

CERTIFIED STATEMENT OF ACCOMPLISHMENT IN SYSTEMS DESIGN

A Certified Statement of Accomplishment in Systems Design is granted to a student who has completed an organized course of study intended to prepare him for effective and creative work in this field. The potentialities of the modern computer have opened new vistas in the entire field of numerical and record work, in scientific computations, accounting, records and file maintenance of many kinds, data retrieval, inventory, simulation of technical processes and management processes, and any of a number of new and less developed fields. The analysis and design of automated systems to accomplish the objectives sought in all such undertakings opens up a challenging new field demanding well-trained specialists. The required courses leading to the certified statement provide the hard core of basic work. The electives offer the student opportunity to emphasize areas that appeal to his own special interest.

Requirements

1. An undergraduate degree, or equivalent in exceptional cases
2. Prerequisite courses
 - Calculus (4)
 - Machine Tabulation I and II (4)
 - Principles of Accounting (3)
 - Principles of Statistical Analysis (3)
3. 24 semester hours of credit in the following specialized courses:
 - Data Processing on Large-Scale Electronic Computers—UNIVAC 1108 (3) or IBM 360 Data Processing System (3) or
 - Programming Honeywell 200 (3)

- ADP System—Analysis, Design, Acquisition, and Operation (3)
- Electronic Data Processing—General (3)
- Cobol Programming—Fundamentals (3) or
- Fortran Programming for Scientific and Business Computers (3)
- Operations Research I and II (6)
- Systems Analysis and Design (6)
- 4. 10 semester hours of credit from the following courses:
 - Electronic Computer Methods for Statisticians (3)
 - Elements of Abstract Algebra (3)
 - Fundamentals of Digital Computer Design (3)
 - Introduction to Linear Programming (3)
 - Introduction to Modern Mathematics (3)
 - Mathematics for Economists (6)
 - Mathematical Programming (3)
 - Mathematical Statistics (8)
 - Numerical Methods in Computation (3)
 - Work Standards and Work Measurement (2)

A student seeking this certified statement should consult with the Registrar and obtain approval of his proposed course of study early in his academic program. Equivalent courses will be accepted by transfer from other institutions.

3-318. Machine Tabulation I (See P. 47)

3-319. Machine Tabulation II (See P. 47)

4-105. Basic Concepts of Data Processing (See P. 57)

3-321. Operators Training IBM 360/30

Fall, 3 credits. Repeated in Spring and Summer

JAMES A. LAIR

Operating techniques of IBM system 360/30 in 1401 compatibility mode, with simulated console instructions and problems. Use of hexadecimal and binary numbering systems. Practical uses of compatibility initialization deck (CID). *No training in actual physical operation of machines.*

3-322. O.S. Operators Training System 360

Fall, 3 credits. Repeated in Spring and Summer

ALAN K. BOROUGH, JR.

Designed to cover all aspects of operating 360 model 40 in 360 and 1401 compatibility mode. Basic job control language needed to run 360 mode. Explanation of operating system. IPL of system. Message given by system. Complete console coverage. Operation of 2540 card reader, 1403 printer, 2400 tape units, and 2311 disk drives to emulate in 1401-1460 mode. New terms used in 360 modes.

3-559. Electronic Data Processing—General

Year, 3 credits each semester

GEORGE J. BROWN
GUILLERMO S. PINON
LUCILLE O. WARNCKE

Designed for subject-matter professional workers desiring technically based understanding of techniques, potentials, and problems of exploiting electronic data processing in their fields. First semester: Oriented mainly to equipment. Organization and components of EDP systems. Programming concepts in machine language and in symbolic representation of machine language. Input-output. Arithmetic. Program logic and control. Distinctions among kinds of machines. Second

semester: Oriented mainly to uses. Systems analysis and flow charting. Representative applications in the Federal Government. Accounting. Statistics. Scientific computation. Information storage and retrieval. Advanced potentials of EDP.

3-345. Computer Programming: Overview

Fall, 3 credits. Repeated in Spring and Summer

DALE COPELAND
ERWIN H. MUSCHTER
CARAL A. SAMPSON

Overview of computer programming, stressing computer characteristics and applications, flow charting, input-output computer communication, use of symbolic and problem oriented languages, and programming techniques. Designed to give the student understanding of these subjects and to tie together loose ends of more specific courses, such as Autocoder, Cobol, Fortran. *Prerequisites:* For the novice and those with other programming courses.

3-563. Data Processing on Large-Scale Electronic Computers

Fall, 3 credits. Repeated in Spring and Summer

WILLIAM M. SPILLANE

Introduction to data processing on large-scale electronic digital computers. Designed to provide the student with a basic understanding of computers, how they function, basic programming principles and techniques, and their capabilities and present limitations. Language of computers. Number systems and codes. Principles of operation. Equipment configuration of EDP systems. Programming. Flow charting. Symbolic coding. Input-output logic. Punched cards. Paper and magnetic tapes. Characteristics of work processes susceptible of automation. Automation of work process. Systems analysis. General purpose programs. Compilers. Generators. Subroutine libraries. Service routines. Multiprogramming on large-scale computer.

3-596. Fundamentals of Digital Computer Design

Fall, 3 credits. Repeated in Spring

MICHAEL A. PARMENTIER

Designed to develop understanding of basic hardware elements of digital computer. Function logic. Minimization using Veitch diagrams, error checking codes, adders, shift registers, counters, propagation of carry and borrow, switching matrices, and eventually basic logic design of simple digital computer from block diagram point of view. No knowledge of circuitry required. Review of Boolean algebra, number systems, base conversion, truth tables, canonical forms, and other appropriate methods. *Prerequisites:* College Algebra and Electronic Data Processing-General or Basic Concepts of Data Processing, or one year's experience in automatic data processing.

3-562. ADP System—Analysis, Design, Acquisition, and Operation

Fall, 3 credits. Repeated in Spring

WILLIAM A. COMBS

Designed to introduce the student to basic principles, concepts, and techniques of analysis and design of automatic data processing systems as well as to provide understanding of procedures and considerations involved in acquisition and operation of ADP installation. Topics: Systems concept. Integrated systems. Scientific versus business applications. ADP study group. Systems specifications. Evaluation of proposals. Impact on organization. Staffing. Grid charting. Flow charting. Block diagramming. Decision tables. Network analysis. System simulation. *Prerequisite:* Electronic Data Processing—General.

3-576. Introduction to UNIVAC 1108

Year, 3 credits each semester

GLORIA A. FERULLO

General purpose, high-performance, multi-processor, multi-programming system with communication capabilities. First semester: Hardware system. Instruction repertoire. Problem solving. Second semester: Executive system. Advanced software. Sort-merge and input-output routines. Problem solving. Service routines. *Prerequisite:* Basic Concepts of Data Processing, or equivalent. No previous computer experience necessary.

3-573. Programming Honeywell 200

Year, 3 credits each semester

ROBERT A. HUDGINS

How to write H-200 programs. Emphasis on class laboratory exercises. First semester: Components, operation, and capabilities of H-200 system. Numbering systems and Honeywell alphanumeric code. Flow charting. Data format. Addressing. Easycode programming. Detailed exposition of Easycode instruction repertoire. Second semester: Continued study in full instruction set. Programming techniques. Indexing. Subroutines. Macro instructions. Input-output control systems. *Prerequisite*: Basic Concepts of Data Processing, or equivalent.

3-592. IBM System 360 Introduction

Fall, 3 credits. Repeated in Spring and Summer

ROBERT A. BECK
IRVING A. COHEN
ANTHONY C. COMITO
PETER M. HAVERLOCK
JOSEPH P. JOHNSON
ALFRED G. MATTMAN
ROBERT E. NICHOLSON
RICHARD S. STRITE
KENNETH D. TARDIFF

For programmers, analysts, operators, and managers who need knowledge of the 360. Storage organization. Interrupt facilities. I/O channels. I/O devices, with emphasis on direct access devices (hardware and data organization). Description of 360 software including introduction to various operating systems. A prerequisite for all other 360 courses. *Prerequisite*: Data Processing on Large-Scale Electronic Computers, or equivalent.

3-607. IBM System 360 Assembly Language Coding

Fall, 3 credits. Repeated in Spring

ROBERT A. BECK
PETER M. HAVERLOCK
J. STEPHEN HEARD
JOSEPH P. JOHNSON
ALFRED G. MATTMAN
RICHARD S. STRITE

For programmers who intend to program 360 using assembler under any 360 operating system. Full 360 instruction set, including fixed-point, floating-point, packed-decimal, and logical instructions. No I/O instructions or other macros. *Prerequisite*: IBM System 360 Introduction, or equivalent.

3-608. IBM System 360 Disk/Tape Operating System Facilities

RONALD S. BUREN
J. STEPHEN HEARD

For programmers, analysts, and managers, using any 360 programming language. *Not* programming course. Disk or tape operation system logical structure. System control and system service program concepts (supervisor, job control, linkage editor, and librarian). DOS multiprogramming support. *Prerequisite*: IBM System 360 Introduction, or equivalent.

3-609. IBM System 360 Disk/Tape Operating System Coding

Fall, 3 credits. Repeated in Spring

PETER M. HAVERLOCK
ALFRED G. MATTMAN

For programmers who intend to program 360 using assembler under control of disk or tape operating system. Data management, IOCS coding for serial and direct access devices. Other system macros. *Prerequisites*: IBM System 360 Introduction, IBM System 360 Assembly Language Coding, and IBM System 360 Disk/Tape Operating System Facilities, or equivalent.

3-610. IBM System 360 Cobol

Fall, 3 credits. Repeated in Spring

JULIUS R. DROZ
PETER M. HAVERLOCK
ALFRED G. MATTMAN
EDWARD G. WILLEY

For programmers who intend to program 360 using Cobol under any 360 operating system. Arithmetic operations. Edit numeric moves. Condition tests. Perform statements. Input-output statements. 360 environment defining. *Prerequisite:* IBM System 360 Introduction.

3-611. IBM System 360 Fortran

Fall, 3 credits. Repeated in Spring

PETER M. HAVERLOCK
ALFRED G. MATTMAN
EDWARD G. WILLEY

For programmers who intend to program 360 under any 360 operating system. Arithmetic statements. Control statements. Input-output and format statements. Subprogramming. *Prerequisite:* IBM System 360 Introduction, or equivalent.

3-612. IBM System 360 PL/I

Fall, 3 credits. Repeated in Spring

KENNETH R. ROBERTS

Programming language I version 4 and 5 under current release of full O.S. language. Program definition. Procedures and statements. Assignments and control statements. Stream and record I/O. Arrays and structures. Subroutines. On-conditions and built-in functions. Compiled time facilities and list processing. File structure and data definition cards. *Prerequisite:* IBM System 360 Introduction, or some IBM System 360 programming experience.

3-613. IBM System 360 O. S. Language Interface

Fall, 3 credits. Repeated in Spring

ROBERT A. BECK

For programmers and analysts wishing to apply problem-oriented language program to be run under O. S. 360. Components of operating system. Data management. Use of job control language. Linkage editor. Debugging of high-level languages. Use of O. S. utility programs. *Prerequisite:* IBM System 360 Cobol, or IBM System 360 Fortran, or IBM System 360 PL/I.

3-614. IBM 1800 Processor-Controller

Fall, 3 credits. Repeated in Spring

WILLIAM H. MISH

Laboratory automation and industrial process control using digital computer as major control device, data recorder, and analyzer. One of more interesting applications of computer. Covers in detail IBM 1800, machine designed specifically to perform these functions in real time environment. Description of hardware, instruction set and assembly language, input/output hardware structure and input/output subroutines, and introduction to time sharing executive monitor system. *Prerequisite:* Basic Concepts of Data Processing, or equivalent with some programming experience desirable.

3-595. Cobol Programming—Fundamentals

Fall, 3 credits. Repeated in Spring

A. R. SCICHLONE
FRANCIS J. SCOTT, JR.
G. VAN STANDIFER
LOUIS ZELLER

How to write Cobol programs. Computer concepts. Role of compiler. Step-by-step development of Cobol language and its application. Debugging Cobol program. Systems analysis for Cobol programming. Laboratory exercises in class. Previous knowledge of computers or programming not necessary. *Prerequisite:* Basic Concepts of Data Processing, or equivalent.

3-589. Fortran Programming for Scientific and Business Computers

Fall, 3 credits. Repeated in Spring

RONALD M. BOLTON
ARLYN D. SCHUMAKER
OLIVER A. SMITH

Designed for personnel intending to become programmers or wishing to broaden programming abilities, as well as subject-matter specialists working closely with data processing organizations. Complete programming system, emphasizing major applications in scientific and engineering fields, using FORTRAN IV programming language. IBM 360/40 as prototype. Indication of instructions applicable to other computers. Basic components. Flow of control. Flow diagramming. Floating point arithmetic. Constants. Variables. Forming expressions in FORTRAN IV. Looping instructions. Input-output instructions, emphasizing differences in FORTRAN IV. Format control. Logic instructions. Subroutines. Arithmetic functions. *Prerequisites*: Basic Concepts of Data Processing and two years college mathematics and/or statistics, or one year college mathematics and one year experience in programming large-scale computers.

3-475. Simulation and Modelling

Fall, 3 credits

DAVID B. WEBSTER

Designed to provide the student with understanding of design, implementation, and application of simulation computer techniques. Simulation discussion covering Monte Carlo simulation, deterministic simulation and models, and simulation language. *Prerequisites*: Fortran programming and theory probability.

3-476. Real-Time Computer Systems

Fall, 3 credits

ARLYN D. SCHUMAKER

Techniques of real-time computer systems. Application of real-time computer systems. Hardware of real-time computer systems. Design calculations of real-time computer systems. Implementation of real-time computer systems. *Prerequisite*: Basic Concepts of Data Processing. Some knowledge of calculus desirable.

3-762. Electronic Computer Methods for Statisticians

Fall, 3 credits. Repeated in Spring

INSTRUCTOR TO BE ANNOUNCED

Designed to provide statistical workers with basis for developing programming and other computer skills and to provide statistical administrators with understanding of computer potentials, problems, and limitations. Machine concepts. Organizing data for computer processing. Writing and testing programs. Numerical analysis. Computational procedures. Subroutines. Library programs. Programming organization. Systems planning for statistical data processing, with particular and specific attention to tabulating and cross tabulating, computing summary and descriptive measures of central tendency and dispersion. Significance tests, and confidence limits and intervals, particularly "t" and "F" tests. Measures of correlation and regression, both simple and multiple, including significance tests. Analysis of variance including determining components of variance. Matrix inversion; measures of trend and of seasonal variation in time series. Computation of index numbers. Special related topics. *Prerequisites*: Undergraduate degree and Principles of Statistics, or equivalent.

3-737. Systems Analysis and Design

Year, 3 credits each semester

ALBERT J. NOWOTNY

Principles, procedures, and techniques of collecting, recording, organizing, evaluating, reporting, and using facts about system and environment in which it operates. Application to creation or invention of completely or partially new schemes of processing data, usually using computers. Consideration of management and organizational demands and adjustments, goals, and resources. First semester: Analysis and design of general computer-application systems. Emphasis on system concept, problem approach, system models, and management and commercial applications. Second semester: Study of "pure" systems. Analysis, design, and development of large-scale systems, real-time code and data structures, management information systems, command-control, process control, and scientific

systems. *Prerequisites:* Specialized required courses for Certified Statement of Accomplishment in Systems Design, or, for general participation, three years' programming experience or equivalent exposure to computers through systems analysis (development or management). Understanding of computer hardware-operation, programming, and scheduled operational procedures.

- 1-516. Data Processing in Medicine (See P. 14)
- 2-153. Automation of Library Operations (See P. 33)
- 3-312. Numerical Methods in Computation (See P. 43)
- 4-106. Information Storage and Retrieval by Computer
(See P. 58)
- 6-441. Improving Personnel Management with ADP
(See P. 84)
- 6-502. Computer Equipment Selection (See P. 87)
- 6-705. Computer Uses in Law (See P. 85)
- 8-685. Engineering Applications of Digital Computers
(See P. 111)
- 8-223. Map Projections and Grid Systems (See P. 119)
- 8-455. Computer Graphics: Theory and Application
(See P. 119)

Office Techniques and Operations

DEPARTMENTAL COMMITTEE

Jerome A. Miles, *Chairman*

Kelsey B. Gardner, Joseph Haspray, Mark M. Kirkham, Ronald B. Krueger, Herbert G. Persil, James H. Ross, William S. Wise, Jr., William T. Wolfrey

Whatever the fields of interest of the organization—science, technology, public administration, private business—and whether huge in size or small, all depend upon the office worker to facilitate their functions. All workers are important: the stenographer, the clerk preparing purchase orders, the bookkeeper keeping the accounts in order, the clerk skilled in personnel actions, the worker in records management. And the supervisor who is immediately responsible for these various activities is indispensable to the organization.

It is in recognition of the vital importance of adequately trained personnel to fill these needs and to provide opportunity for supplemental and refresher courses in this general field that the Department of Office Techniques and Operations offers the following courses. They are in large measure practical, how-to-do-it courses of interest generally to persons working with these procedures, or who hope to train themselves for such positions. Of course, these courses are also helpful to persons such as supervisors and administrative assistants in positions requiring some familiarity with these procedures and also to persons of higher levels of responsibility who desire to know more of the details of these operations.

CERTIFIED STATEMENT OF ACCOMPLISHMENT IN ADMINISTRATIVE PROCEDURES

A Certified Statement of Accomplishment in Administrative Procedures is granted to a student who has completed an organized program designed to provide basic training in administrative procedures. This program should be of special interest to those already employed in administrative work of the procedural type, those who wish to enter administrative work, and those who wish to become administrative assistants or to head units concerned with administrative procedures. An applicant for the certified statement must file a transcript of his high school or college record before completion of his program.

Requirements

1. Graduation from high school.
2. 16 semester hours of credit with the grade of C or better in each of the courses taken:
 - a. Required courses: (10 credits)
American National Government (3)
7 semester hours from courses above 100 level in Office Techniques and Operations or Public Administration. Courses in accounting may not be included, except for Federal Fiscal Procedure and Federal Government Accounting.

b. Elective courses: (6 credits)

Remaining hours of credit may be selected from other courses in Office Techniques and Operations, excluding shorthand. Elementary statistics and a course in automatic data processing may be included.

A student seeking this certificate should consult with the Registrar and obtain approval of his proposed course of study early in his academic program. Equivalent courses will be accepted by transfer from other institutions.

Administrative Procedures

4-101. Everyday Mathematics

Fall, 2 credits. Repeated in Spring and Summer

C. M. MOUSER
GARLAND S. GUYTON

Designed for clerical workers called upon to apply fundamentals of arithmetic to their jobs. Emphasis on review of business arithmetic, including fractions, decimals, ratios, and percentages. Special applications to Civil Service and business problems such as bank, cash, and trade discount, profit and loss, payrolls, simple and compound interest, fire insurance, stocks and bonds, property and income taxes, and determination of interest rates charged on time purchases and small loans.

3-8. Intermediate Algebra

(See P. 40)

4-105. Basic Concepts of Data Processing

Fall, 3 credits. Repeated in Spring and Summer

WILLIAM T. ALEXANDER
RONALD M. BOLTON
MAURICE D. GEIGER
ROBERT E. NICHOLSON
HUBERT P. NUCCI
PAUL C. REDMER
JOHN M. RICHARDSON
CHARLES W. SCHROYER
RICHARD S. STRITE
GLENN W. SUTER
EDWARD G. WILLEY

Designed to introduce data processing to the student entirely new to the field. Examination of areas of understanding required by nonprofessionals or those interested in programming instruction, but without background experience. Topics: Punched card data processing. Coding systems. Computer and stored program concepts. Data preparation and print-out formats. Methods of problem definition. Data processing terminology.

4-111. Principles of Machine Programming I

Fall, 3 credits

ROBERT E. NICHOLSON

Designed to follow Basic Concepts of Data Processing. Essential elements of programming using machine symbolic language. Principles of machine programming system. Review of flowcharting method of problem analysis. Use of computer instruction set. Input/output methods and systems. *Prerequisite:* Basic Concepts of Data Processing.

4-119. Principles of Machine Programming II

Spring, 3 credits

ROBERT E. NICHOLSON

Designed to follow Principles of Machine Programming I. Machine operation and systems aids. Fundamentals of at least two procedure or compiler languages, *i.e.*, FORTRAN and COBOL. *Prerequisite:* Basic Concepts of Data Processing. Principles of Machine Programming I desirable.

4-106. Information Storage and Retrieval by Computer

Fall, 3 credits. Repeated in Spring

WILLIAM P. HENKE

Designed for information specialists, librarians, and other professionals concerned with handling large volumes of information. Design and use of digital computer systems for automated information storage and retrieval. Classification and indexing of information for computer storage. Preparation of input data and principles of file organization, updating, and maintenance. Methods of searching and retrieval. Presentation of results. Systems design and evaluation.

4-108. Administrative Procedure

Fall, 2 credits. Repeated in Spring and Summer

MICHAEL J. BARTOLOMEO
STANLEY B. MILLER
CLAUDE R. WRIGHT

Designed for the student who wishes to become a supervisor or administrative assistant, or who has such a position in a small organizational unit. Day-to-day assignments in such units. Preparation of budget data, proper establishment of authority and responsibility, organizational structure, fundamentals of personnel administration, and requirements essential for good supervision. Introduction to administrative planning, administrative procedures, and management generally at lowest organization level, including work reporting and work measurements, work processes, and work control reports. Relation of these studies to budgetary and personnel needs of unit. Theory of staff versus operating jurisdiction over administrative planning.

4-201. Modern Supervisory Practice

Fall, 2 credits. Repeated in Spring

EDWARD KOENIG
WILLIAM R. VAN DERSAL

Designed for supervisors or those interested in becoming supervisors. Study and application of principles of supervision, supervisory techniques, participation, motivation, communications, organization principles, workload analysis, planning, scheduling, work improvement studies, and solving problem cases prepared by students.

6-202. Management—Seminar

(See P. 78)

4-206. Essentials of Good Office Management

Fall, 3 credits. Repeated in Spring

GLENN D. WAGNER

Designed to give better understanding of principles and techniques of effective management and their practical applications. Review of current research and thinking. Comparison of practices in Government and industry. Problems and questions relating to office management: organizing for effective operations, planning and control of work, utilization of office equipment and services, paper-work management, human relations problems, coordinated effort and team work, and effecting improvements.

4-112. Federal Fiscal Procedure

Year, 2 credits each semester

BENEDICT E. FINOTTI
BORIS ROBBINS

Intended to provide comprehensive understanding of basic fiscal and accounting laws, rules and regulations of the Federal Government and their application to specific fiscal activities. Relationship of executive departments with staff agencies, basic fiscal procedural sources. Covers in detail each type of fiscal operation, including use and processing of accounting and fiscal forms, disbursements and collections, and related records and reporting. First semester: General background of laws and regulations. Symbolization of accounts. Processing of payrolls. Handling of leave, retirement, tax, and bonds, and administrative examination of travel and transportation payments. Second semester: Continuation of study of basic laws, rules and regulations covering fiscal and accounting activities, with emphasis on procedures involving disbursements for supplies, equipment, utilities, and other items, use of imprest funds and agent cashiers. Handling of billings, collections, and deposits. Effecting adjustments for errors. Handling claims and uncollectible debts. Responsibilities of certifying officers.

4-113. Federal Property Procedure

Spring, 2 credits

KIMBER H. BOYER

For those in personal property work or who wish to enter field. Laws, regulations, principles, and procedures dealing with accountability and control, utilization, and disposal of Federal personal property. Accountability systems, capitalization policies, inventory controls, reports, surveys, and inspections. Development and application of use, replacement, and preventive maintenance standards. Disposal by transfer, donation, sale, abandonment, and destruction.

4-114. Federal Personnel Procedure

Fall, 2 credits. Repeated in Spring and Summer

EDWARD J. MORIARTY
HENRY C. STARNES

Elementary principles and procedures of Federal personnel administration, including study of Federal personnel structure and organization, rules and regulations of the Civil Service Commission, and other basic procedural sources. Use of personnel forms and records. Civil Service examinations and recruitment. Appointments. Transfers. Promotions. Separations and reductions in force. Suspensions and disciplinary actions. Retirement. Performance ratings. Leave and hours of duty.

4-115. Federal Purchasing Procedure

Fall, 2 credits. Repeated in Spring

TONY M. BALDAUF
FRANK GEARDE, JR.
ROGER C. THOMAS

For those in purchasing work or who wish to enter field. Historical and legal background of Federal purchasing, professional concepts in purchasing, current legal requirements, purchasing procedures from open market and Federal sources of supply, and purchasing techniques. Practical application of such requirements through the preparation of purchase documents. Case problems involving legal or administrative restrictions, or requiring application of purchasing principles.

4-116. Federal Budgetary Procedure: Formulation and Presentation

Fall, 2 credits. Repeated in Spring

THOMAS E. HOADLEY
STANLEY E. JOHNSON
RICHARD W. MURRAY

Designed for the student interested in entering budget work, those already in budget work, or others in related fields interested in formulation phase of budget procedure. Basic legal and institutional framework, concepts, procedures, and practices involved in preparation of budget estimates, justifications and supplementary materials. Emphasis on budget procedures at bureau or small agency level. Preparation of budget estimate for hypothetical government agency. *Prerequisite:* Familiarity with basic concepts and terminology used in fiscal, accounting, or other financial operations of the Federal Government.

4-118. Federal Budgetary Procedure: Execution and Fund Control

Fall, 2 credits. Repeated in Spring

MICHAEL J. BARTOLOMEO
LEONARD A. PASS

Designed for the student interested in entering budget work, those already in budget work, or others in related fields interested in performance phase of budget procedure. Systems of administrative control under the Antideficiency Act, allotments, apportionments, review of progress in relation to financial plans, related reports, and other aspects of budgetary control over appropriations and funds. Problems and discussion illustrating various steps of budget execution process at bureau or small agency level and review of basic laws, regulations, concepts, and terminology involved. *Prerequisite:* Familiarity with basic concepts and terminology used in fiscal, accounting, or other financial operations of the Federal Government.

4-117. Records Management Procedure

Fall, 2 credits

E. O. BIRGE and DONALD J. GOETTSCHÉ

Introduction to management of records. Basic instruction in processing, maintaining, and servicing records. Designed for the student interested in supplementing his knowledge of mechanics and techniques of records operations, or who desires to enter records management field. Theory and structure of various systems of classifying and filing records. Selection of filing systems based on identification of features of papers and needs of users. Selection and proper use of filing equipment and supplies. How to meet needs of management for documentation and information from records. Detailed instruction in methods of recording and controlling communications. Classifying, coding, indexing, and filing correspondence and other record material. Reference service, including establishment and operation of charge-out and follow-up systems.

4-217. Advanced Records Management

Spring, 2 credits

E. O. BIRGE and DONALD J. GOETTSCHÉ

Advanced records management. Lectures on applicable management principles and techniques, group discussions of paperwork problems, and case studies illustrating practical solutions. History of growth of Federal records, increase of related paperwork problems, and Government efforts to solve them. Federal laws and regulations governing establishment, maintenance, protection, preservation, and disposal of records. Development and evaluation of records management programs, planning and conduct of records management surveys, inventory and evaluation of records, application of management problems and techniques to records maintenance and disposition problems, development and application of records retention and disposal standards, and retirement, storage, microfilming, and disposal of records. *Prerequisite:* Records Management Procedure, or qualifying experience at Grade GS-5 or above, or special permission.

4-412. Reports and Forms Management

Fall, 2 credits. Repeated in Spring

WILLIAM B. RICE and ROBERT H. MEEHAN

Designed to acquaint the student with management significance of reports and forms. Role of paperwork in general and reports and forms in particular in modern administration. Potential for management improvement and economy through better reports and forms. Emphasis on improving contribution of documents to systems and procedures they serve. How to install, operate, and appraise reports and/or forms management.

4-410. Directives Systems Management

Fall, 2 credits

WARREN J. VIBBARD

Designed for the student interested in managerial communications, staff management capacities where policies and procedures are formulated—and directives management, or related fields. Communicating policy guidance and standing operating instructions in Federal Government agencies. Relationship between mission, organization, and size of agency and its directive system. Mechanics and operations of issuing and controlling directives. Red tape, bureaucracy, and paper work management. Characteristics of effective directives systems. Formal and informal communications and organizational discipline.

4-421. Writing Procedures and Instructions

Spring, 2 credits

WARREN J. VIBBARD

Designed to increase competence in instructional writing. Study and practice of principles and techniques applicable to writing of formal procedures and instructions, especially for codified manuals. Discussion of expository writing, format, style, and use of illustrations. Development of outline for, and preparation, review, and revision of actual instruction. *Prerequisite:* Management of Directives Systems, or experience at Grade GS-5 or above in the composition of written instructions.

4-330. Government Letter Writing

Fall, 2 credits. Repeated in Spring

LYMAN J. NOORDHOFF

Designed for those who want to write clearer, more effective letters and memoranda so reader understands them easily. Principles and practice in planning, writing, and rewriting correspondence. Writing accurate, human, clear, concise, courteous letters. Emphasis on adjusting writing to intended reader. Movie and visual aids. *Prerequisite*: High school ability in English.

Shorthand

The courses in shorthand are designed to offer a program of training for a stenographic career in the Federal service. Each course represents a separate unit of study, in which emphasis is placed on materials similar to those used in the Federal Government. The sequence of courses presents a sound foundation to qualify for the various grades of stenographers in the Federal service.

The student must have a good command of English. Otherwise Practical English Usage or English for Secretaries should be taken before registering for a shorthand course.

Review of Gregg Shorthand (Anniversary) serves as a rapid review course for the student who has not used his shorthand recently, or who needs additional practice in office dictation. The student who wishes to review Simplified or Jubilee Gregg should enroll in Gregg Shorthand, 60-80 Words.

In order to reach the goals stated in the course description, home study is essential. The amount of study varies with the learning ability and requirements of the individual student.

2-35. English for Secretaries

(See P. 23)

4-129. Gregg Shorthand I

Fall, 3 credits. Repeated in Spring and Summer

DOROTHY Z. BREWER
RAYMOND J. FRITZ
CHARLES J. GROS
AMIL W. JACKOWSKI
JOAN ANN MURPHY
YVONNE L. OLSEN
BETTYE A. PAYTON
GOLDIA B. SHAW
VINCENT B. VALLIERES

Theory of Gregg Shorthand jubilee. Beginning dictation on new and familiar material.

4-130. Gregg Shorthand II

Fall, 3 credits. Repeated in Spring and Summer

DOROTHY Z. BREWER
RAYMOND J. FRITZ
CHARLES J. GROS
AMIL W. JACKOWSKI
JOAN ANN MURPHY
YVONNE L. OLSEN
BETTYE A. PAYTON
GOLDIA B. SHAW
VINCENT B. VALLIERES

Increasing mastery of principles of Gregg Shorthand jubilee through review and drill. Minimum dictation speed of 60 words a minute attained, with accurate transcription on new standard material. *Prerequisite*: Gregg Shorthand I, or equivalent.

4-225. Gregg Shorthand III (60-80 Words)

Fall, 3 credits. Repeated in Spring and Summer

DOROTHY Z. BREWER
RAYMOND J. FRITZ
CHARLES J. GROS
AMIL W. JACKOWSKI
JOAN ANN MURPHY
YVONNE L. OLSEN
BETTYE A. PAYTON
GOLDIA B. SHAW
VINCENT B. VALLIERES

Review of theory. Brief forms, word beginnings and endings. Preliminary phrasing. Extensive dictation practice, using general business and governmental material. In-class and outside transcription. Sample Civil Service test material. Minimum dictation speed of 80 words a minute attained. *Prerequisite:* Gregg Shorthand I and II, or equivalent, and minimum speed of 60 words a minute on new standard material.

4-226. Gregg Shorthand IV (80-100 Words)

Fall, 3 credits. Repeated in Spring and Summer

MARCELLA E. TROTTONOW

For the shorthand writer of any system with dictation speed of 80 words a minute and ability to transcribe letters and reports accurately.

4-227. Gregg Shorthand V (100-120 Words)

Fall, 3 credits. Repeated in Spring and Summer

ILDA DOW

For the shorthand writer of any system with dictation speed of 100 words a minute. High speed shortcuts. Civil Service tests and Gregg awards.

Physical Sciences

DEPARTMENTAL COMMITTEE

Alfred Weissler, *Chairman*

Bernard H. Armbrrecht, William E. Benson, Irwin Hornstein, Max Klein, John G. Manning, Elliott S. Pierce, John J. Schule, Jr., Nathan Seeman, Benjamin Tepper, William R. Thurston

Professional and cultural courses in this department afford unusual opportunity for study under guidance of practicing scientists. Unless specifically stated, there is no laboratory work.

General

5-35. Exploration of Universe—Study Discussion Group

Spring, non-credit. Repeated in Summer

FRED SCHULMAN

To help promote general understanding of scientific processes and some philosophical and political issues involved in or resulting from growth of modern science. Topics for discussion include: Nature of science. Scientific method. Creation of the universe. Challenge of space age. National response. Technology of space. Values and limitations of science.

5-349. Introduction to Space Science

Fall, 2 credits

ROBERT F. FELLOWS

Lectures and sample problems in space sciences. Application of rockets to study of earth and other planetary atmospheres and ionospheres, including origin, composition, structure, and dynamics. Nature and characteristics of energetic particles in space including galactic cosmic radiation, trapped radiation (Van Allen type), solar flares, and particles. Theories explaining mechanisms accelerating particles. Origin, nature, and theory of magnetic fields and use of space probes and satellites in their measurement and characterization. Solar-terrestrial relationships. Biological systems and space environment. Search for extra-terrestrial life. Micrometeorites and cosmic dust. Radio astronomy from space vehicles. Description of space science research program of United States and other nations. (Course not concerned with technology of launching vehicles or manned-space flight.) *Prerequisites:* College level courses in calculus and physics, or equivalent.

5-175. General Astronomy

Year, 3 credits each semester

ALAN D. FIALA

First semester: Stellar constellations and astronomical coordinate systems. Time, the earth, and general view of solar system. Basic physical principles governing planetary motion and radiation of light, with minimum use of elementary mathematics. Tools of astronomers, such as optical and radio telescopes, spectrographs, and radiation detectors. Nature and characteristic features of individual planets. Second semester: Stellar systems. Introduction to sun as best known star. Physics of stars, intrinsic variable stars, and multiple stellar systems, such as visual, spectroscopic, and eclipsing binaries. Interstellar matter, clusters, and galaxies. Current theories of stellar evolution and cosmology. *Prerequisites:* No knowledge of astronomy required. Mathematics on high school level helpful.

5-113. Introduction to Astronomy

Summer, 2 credits

ALAN D. FIALA

General survey of our knowledge of earth, solar system and universe, and methods by which such information is obtained. Emphasis on basic physical principles, results obtained, and their limitations. Some observing, as weather permits. *Prerequisite*: Previous exposure to physical science on high school level helpful, but not required.

5-176. Radio Astronomy

Spring, 2 credits

ROBERT W. HOBBS

Introduction to study of celestial bodies by radio waves that they emit. Special emphasis on relationship between optical and radio astronomy. Antennas. Radiometers. Observing procedures. Solar system radio sources. Galactic radio sources. Extragalactic radio sources. Quasi-stellar radio sources. *Prerequisite*: Some knowledge of astronomy helpful, but not necessary.

5-596. Introduction to Pharmacology

Year, 3 credits each semester

SAM A. MARGOLIS

First semester: Drugs acting on nervous system, cardiovascular system, and smooth muscle. Second semester: Drugs acting on body fluids and alimentary tract, diagnostic and immunologic agents, vitamins and nutritional agents, and drugs acting on foreign organisms. Discussion in both semesters in following areas for each drug or group of drugs: Physiological basis of action, pharmacological actions, indications and contraindications, structure function relationships, and dosage and toxicity. *Prerequisites*: Applied Physiology and Organic Chemistry.

5-765. Practical Electronics for Biologists and Chemists

Year, 2 credits each semester

PAUL E. WILKINS

First semester: Nonmathematical physical explanation of basic principles of electricity. AC and DC circuits. Passive electronic components. Vacuum tubes and transistors. Chemical and biological transducers. Practical information on measurements, trouble shooting, design, and limitation of instrumentation. Demonstrations on construction and application of hardware items. Second semester: Specific electronic instrumentation. Problems in spectrophotometry, spectroscopy (visible, IR, electron, and neutron), recording instruments, vacuum technology, feedback control systems, nuclear magnetic resonance, and the like. *Prerequisite*: Bachelor's degree.

6-507. Governing Science and Technology (See P. 76)

Chemistry and Physics

5-100. General Chemistry

Year, 3 credits each semester

MARTIN HEITZBERG

Designed to provide background in problems and practices of chemistry for workers in other professional fields and for subprofessionals in chemical work. Descriptive chemistry of commoner elements and consideration, at appropriate level, of atomic theory, periodic table of elements, valence, acid-base concepts, oxidation-reduction reactions, reaction rates and equilibria, pH, normality and molarity, and stoichiometry. Consideration of mathematical problems related to chemistry. *Prerequisite*: High school algebra.

5-248. Organic Chemistry

Year, 3 credits each semester

ROBERT J. SHINE

Study of properties and reactions of carbon compounds. Major emphasis on systematic presentation of various groups of organic compounds. Application of modern chemical theory to elucidation

of structure and mechanism. Modern spectroscopic methods of structural determination. Use of ball- and stick-models to explain three-dimensional phenomena. Emphasis throughout on general principles and utility of organic chemistry to everyday life. *Prerequisite*: General Chemistry, or equivalent.

5-512. Advanced Organic Chemistry

Year, 3 credits each semester

ALBERT E. POHLAND

First semester: Atomic and molecular structure. Steric and resonance effects. Acids and bases. Nucleophilic and electrophilic substitutions. Carbanions. Carbonium ions. Enolization. Addition reactions. Second semester: Molecular rearrangements. Participation of neighboring groups and non-classical carbonium ions. Beta-elimination reactions. Free-radical and stereochemistry. Reactions of small and large ring systems: *Prerequisite*: Organic chemistry, or equivalent. Bachelor of Science degree preferred.

5-404. Organic Chemistry of Pesticides

Fall, 3 credits

WALTER R. BENSON

Organic pesticide as one major weapon against harmful insects, plants, rodents, and fungi. Chemistry of this group, including preparation, classification, physical properties, and chemical reactions. Chemical basis for general qualitative and quantitative organic reactions used in modern residue analyses. Instrumental techniques, literature, photolysis, and metabolism of pesticides. Guest lecturers. *Prerequisite*: One semester of undergraduate organic chemistry.

5-315. Elementary Biochemistry

Year, 2 credits each semester

DONALD F. FLICK

Comprehensive survey of chemistry of body constituents and metabolic conversion. First semester: Chemistry of carbohydrates, fats, proteins, and fundamentals of enzyme chemistry. Second semester: Digestion and absorption of food, intermediary metabolism, and the physiological role of vitamins and hormones. *Prerequisite*: Organic Chemistry.

5-320. Basic Biochemistry

Year, 2 credits each semester

LOUIS FEINSTEIN

First semester: Comprehensive survey of biochemistry at elementary level. Structure, function, and interrelationship of carbohydrates, fats, proteins, vitamins, minerals, hormones, and enzymes. Second semester: Modern experimental approaches to metabolism at cellular level and in whole organism. General and specific topics in plant biochemistry and animal biochemistry. *Prerequisite*: Elementary organic chemistry.

5-406. Nutritional Biochemistry

Fall, 2 credits. Repeated in Spring

JAMES S. ADKINS

Basic scientific and practical aspects of nutritional biochemistry. Essential principles of adequate nutrition. Role and significance of nutrients. Chemical changes that these constituents undergo in process of metabolism. Interaction and integration of many factors that influence nutritional status. *Prerequisite*: Organic Chemistry. Elementary Biochemistry helpful.

5-511. Cellular Biochemistry

Spring, 2 credits

SAM A. MARGOLIS

Isolation of cellular and subcellular elements. Biochemical consideration of nature of members at cellular level—animal membranes, and plant membranes including role of cell wall. Integration of enzyme systems into cell structures—mitochondrion, and chloroplast. Processes, location, and vectorial properties of oxidation, energy conservation, and ion translocation. Biochemical theory and physical theory of mitochondrial energy processes. Other subcellular functional units including microsomes, their heterogeneity in structure as associated with their biochemical functions; lysosomes; oxysomes, and soluble enzyme mosaics, e.g., fatty acid synthetase. *Prerequisite*: Elementary Biochemistry.

5-403. Biochemistry of Steroid Hormones

Fall, 3 credits

WILEY W. TOLSON

Biological actions of androgens, estrogens, progesterone, adrenocorticoids, and related steroids. Analytical procedures for determination of certain steroid hormones in biological specimens. Structures and nomenclature of these compounds. *Prerequisite*: Organic Chemistry, or equivalent.

5-339. Physical Chemistry

Year, 3 credits each semester

STANLEY ABRAMOWITZ

Thermodynamics. Chemical and phase equilibria. Kinetic theory. Structure of atom and molecules. Chemical statistics. Chemical kinetics. Electrochemistry. Liquids. Solid state chemistry. *Prerequisites*: College mathematics through calculus.

5-525. Advanced Physical Chemistry

Year, 3 credits each semester

MARTIN HERTZBERG

Thermodynamics, chemical kinetics, and quantum chemistry. Intended mainly for first year graduate students. Comprehensive review of theoretical foundations of chemistry. *Prerequisites*: Physical Chemistry and mathematics through calculus.

5-717. Radiobiochemistry

Spring, 3 credits

BENJAMIN H. BRUCKNER

Comprehensive treatment of radionuclides and their applications to biochemistry. Fundamentals of radioactive decay processes, interactions of radiation with matter, detection and measurement of radiation, and statistical considerations. Principles of use of radioisotopes in chemical and biochemical problems, tracer methods, and techniques. Biological effects of radiation, basic health physics, and safety principles. *Prerequisite*: Bachelor's degree in physical sciences, or special permission.

5-408. Nuclear Magnetic Resonance Spectroscopy

Fall, 3 credits

JAMES A. FERRETTI

Physical foundations of nuclear magnetic resonance (n.m.r.). Analysis and interpretation of n.m.r. spectra, with emphasis on applications to structural chemistry. *Prerequisites*: College chemistry and physics.

5-423. Spectral Identification of Organic Compounds

Spring, 3 credits

JAMES A. FERRETTI

Principles of spectroscopy and application to analysis of organic molecules. Techniques including mass, infrared, ultraviolet, and nuclear magnetic resonance spectroscopy. Emphasis on analysis of unknown organic molecules by combination of these techniques.

5-155. Principles of Physics

Year, 3 credits each semester

ALBERT E. SMITH

Designed to acquaint the student with fundamental phenomena and laws of mechanics, light, heat, electricity, magnetism, and modern physics. Designed for the non-science student who wishes introduction to physics. *Prerequisite*: High school algebra.

5-126. Modern Physics

Fall, 2 credits

RICHARD J. DRACHMAN

Introduction to atomic and nuclear physics, with emphasis on present day research problems. Programmed textbook used in conjunction with lectures and discussion. *Prerequisite*: One year of college physics, or equivalent.

5-127. Physics of Modern Life

Spring, 2 credits

RICHARD J. DRACHMAN

Application of basic principles of physics to understanding of important processes and devices of today. Communications, flight, spaceflight, refrigeration, and others. Directed to satisfying curiosity of interested layman. Not how-to-do course. *Prerequisite*: Basic physics course.

5-411. Modern Biophysics

Fall, 3 credits

HAROLD LECAR

Physicist's approach to biological phenomena, including cell membrane formation and function, analysis of macromolecular conformation and interaction, nerve and muscle action, transport of material by living systems, and biological organization. Emphasis on aspects enjoying rapid progress today. *Prerequisites*: Elementary college level courses in chemistry and physics.

5-745. Principles of Masers and Lasers

Fall, 3 credits

H. HARRISON

Analysis of masers and lasers, emphasizing fundamental relations for generation and amplification of coherent radiation by stimulated emission. Pertinent portions included of electromagnetic wave theory, quantum mechanics, atomic, molecular, and solid state physics. *Prerequisite*: Bachelor of Science degree in engineering, mathematics, or physical science.

5-422. Instrumental Methods of Analysis

Fall, 3 credits

LEO KAZYAK

Introduction to theory, techniques, and applications of ultraviolet and infrared spectroscopy, gas chromatography, mass spectrometry, and electrochemistry. Basic consideration of automation and computerization as they apply to these techniques. Demonstrations. *Prerequisites*: General Chemistry and Physical Chemistry, or equivalent.

5-418. Introduction to Gas Chromatography

Spring, 3 credits

LEO KAZYAK

Elementary course in fundamentals and techniques of chromatography. Detectors and detector sensitivity, effects of temperature, gas flow, and gas pressure and column preparation. Simple applications of gas chromatography to analysis of gases and volatile compounds. *Prerequisite*: General Chemistry, or equivalent.

Geography and Geology

Courses in Meteorology, Oceanography, and Surveying and Mapping are closely related to this field.

5-203. General Geology

Fall, 3 credits

RAYMOND C. DOUGLASS

Minerals and rocks as constituents of earth's crust. Processes of weathering, erosion, and deposition. Vulcanism. Structures of sedimentary and igneous rock formations. Diastrophism. Mountain building. Land forms and their relation to various geologic processes. Stability of earth's crust. Classroom exercises in study of common minerals and rocks and interpretation of topographic and geologic maps. Field trips to study rocks and geologic setting of greater Washington area. *Prerequisite*: Inorganic chemistry desirable.

5-204. Historical Geology

Spring, 3 credits

RAYMOND C. DOUGLASS

Study of development of earth through time, growth and destruction of mountains, origin of sedimentary formations, and development of plants and animals from first meager evidences of life to present. Field and laboratory study of rocks and fossils of representative geologic ages exposed in greater Washington area. *Prerequisite*: General Geology, or acquaintance with principles and processes of physical geology.

5-704. Water Resources

Fall, 3 credits

JOHN D. BREDEHOEFT

Designed to acquaint the student with spectrum of work currently in progress in water resources. Approach based upon systems analysis. As background, methods of both surface-water and ground-water hydrology are presented, including rainfall-runoff models and base-flow models. Detailed consideration of optimization of water resources systems. Linear programming and dynamic programming models: Comprehensive simulation models for ground-water-farming economy system and for conjunctive ground-water-surface water-farming economy. *Prerequisite*: Elementary knowledge of calculus desirable.

[5-533.] Hydrology (1971-72 and alternate years)

Year, 3 credits each semester

DONALD R. BAKER

Basic and applied hydrology at professional level. First semester: Elementary hydraulics. Measurement and interpretation of streamflow, precipitation, and other basic data. Hydrologic cycle. Physics of soil moisture. Infiltration theory. Wave travel and unit hydrograph. Second semester: Development and application of procedures for applying basic hydrology to practical problems of river forecasting and design of water control works, including streamflow routing, flood frequency, rational method of estimating flood magnitude, hydrometeorology, forecasting of runoff, influence of water control structures on streamflow, and problems of water control operation. *Prerequisites*: College algebra and physics. Elementary meteorology, statistics, and engineering desirable.

7-260. Economic Geography (See P. 99)

2-114. Maps and Charts (See P. 32)

8-208. Aerial Photographic Interpretation (See P. 118)

8-408. Advanced Aerial Photographic Interpretation
(See P. 118)

Meteorology

The following courses in meteorology are offered in cooperation with the United States Weather Bureau. Registration is open to all qualified students.

5-326. General Meteorology

Spring, 3 credits

HUGO V. GOODYEAR

Fundamentals of physical aspects of modern meteorology for the professionally interested student. Atmospheric composition and structure and their measurements. Solar and terrestrial radiation and radiation laws. Gas laws. Adiabatic, pseudoadiabatic, and non-adiabatic processes. Fronts. Thunderstorms. Fog. Wind. *Prerequisites*: Two years of high school algebra and trigonometry.

5-415. Applied Climatology

Fall, 3 credits

FRANKLIN NEWHALL

Discussion of statistical tools of climatological analysis needed for solution of applied problems. Solution of examples from agriculture, aviation, engineering, and specialized aspects of industry. The student works these problems as exercises.

[5-534.] Dynamic Meteorology (1971-72 and alternate years)

Year, 3 credits each semester

GERALD A. PETERSEN

Application of general principles of mechanics, thermodynamics, and fluid motions to study of atmosphere and its movements. *Prerequisites*: College physics and mathematics through differential and integral calculus, or equivalent.

[5-536.] Synoptic Meteorology (1971-72 and alternate years)

Year, 3 credits each semester

E. PAUL McCLAIN

Description and explanation of circulation and weather processes observed in atmosphere, with emphasis on forecasting applications. First semester: Air motion, three-dimensional structure of pressure and wind systems, cyclones, anticyclones, front, air masses, and prognosis of circulation pattern. Second semester: Temperature forecasting, clouds and precipitation, fog and other visibility phenomena, thunderstorms, squall lines, tornadoes, turbulence, icing, sea breeze, and mountain and valley winds. *Prerequisites*: General Meteorology, college physics and calculus, or special permission.

5-407. Environmental Satellites—Their Application to Meteorology, Oceanography, and Hydrology

Fall, 2 credits

E. PAUL McCLAIN

Existing and planned environmental satellite systems, including TIROS, Nimbus, Applications Technology, and Earth Resources Technology satellites. Orbital geometry. Control systems. Sensors. Ground coverage. Data characteristics. General and specific applications of environmental satellite data to research and operational problems in meteorology, oceanography, and hydrology. *Prerequisites*: College algebra and physics courses and General Meteorology or General Oceanography.

5-662. Marine Meteorology (*See P. 72*)

Oceanography

The following courses in oceanography are offered in cooperation with the United States Naval Oceanographic Office. They may be taken individually, or as a program leading to a certified statement of accomplishment. Registration is open to all qualified students.

CERTIFIED STATEMENT OF ACCOMPLISHMENT IN OCEANOGRAPHY

A Certified Statement of Accomplishment in Oceanography is granted to a student who has completed an organized program of courses in the field.

Requirements

1. 20 semester hours of credit with a grade of C or better in each of the following courses:
 - a. Required courses (7 credits)
 - Biological Oceanography (2)
 - Geological Oceanography (3)
 - Physical Properties of Sea Water (2)
 - b. Electives (7 credits)
 - Applied Underwater Sound (2)
 - Biological Oceanography (2)
 - Chemical Oceanography (2)
 - Dynamic Oceanography (2)
 - Marine Geophysics (2)
 - Marine Meteorology (2)
 - Ocean Engineering (3)
 - Ocean Surface Waves (2)
 - Oceanographic Remote Sensing (2)
 - Physics of Marine Atmosphere (2)
 - Practical Electronics for Biologists and Chemists (4)
 - Principles of Underwater Sound (2)
 - c. 6 semester hours of credit in fields related to oceanography, including biology, chemistry, engineering, geography, geology, mathematics, and meteorology.

A student seeking this certified statement should consult with the Registrar and obtain approval of his proposed course of study early in his academic program. Equivalent courses will be accepted by transfer from other institutions. An applicant for this certified statement must file a transcript of his high school or college record before completion of his program.

5-360. General Oceanography

Fall, 2 credits. Repeated in Summer

P. BURR LOOMIS
ROBERT A. PELOQUIN

Characteristics of oceans and factors that control distribution of properties and of plants and animals. Biology, chemistry, geology and physics of the oceans. *Prerequisite:* College courses in at least two of the physical or biological sciences.

5-409. Piloting and Electronics Navigation

Fall, 3 credits

KARL H. ACKERMAN

Nautical chart. Aids to navigation. Piloting instruments. Magnetic compass. Dead reckoning and other plots. Position fixing. Mathematical solutions of sailings. Piloting publications and their uses. Basic principles of electronic navigational systems and their use. International and Inland Rules of Road.

5-414. Celestial Navigation

Spring, 3 credits

KARL H. ACKERMAN

Celestial, terrestrial, and horizon coordinates systems. Astronomical definitions. Time and nautical almanac. Chronometer and marine sextant. Observational corrections and errors. Mathematical and tabular solutions of navigational triangle. Position fixing by altitude intercept and line of position methods. Special techniques. Latitude by meridian altitude and reduction to meridian. Longitude by observations on prime vertical. Star identification.

5-475. Principles of Underwater Sound

Fall, 2 credits

ROBERT S. WINOKUR

Fundamental principles of acoustics and application of these principles to underwater sound. Transmission of sound in the sea, including refraction, reflection, scattering, attenuation, and fluctuation. *Prerequisites*: Calculus and college physics.

5-476. Applied Underwater Sound

Spring, 2 credits

ROBERT S. WINOKUR

Applied theory and practice for those entering the field or working in related fields. Ray theory, normal mode theory, sound channels, noise and reverberation, measurement techniques, and elements of transducer design. *Prerequisite*: Principles of Underwater Sound, or equivalent.

5-584. Physical Properties of Sea Water

Spring, 2 credits

WILLIAM C. PAULUS

Examination of physical principles governing properties of sea water. Comparison of these properties with those of pure water. Definition and calculation of salinity and density. Distribution of salinity, temperature, and density.

5-655. Ocean Surface Waves

Spring, 2 credits

JOHN J. SCHULE, JR.

Measurable properties of ocean surface waves and the methods of observing and analyzing ocean waves. Demonstration of wave solution to hydrodynamic equations. Discussion of various sea surface models including their assumptions, solutions, and practical applications. Problems of propagation of waves in dispersive medium. Examples of various forecasting techniques. *Prerequisite*: Calculus, or Mathematics for Oceanographers.

5-549. Chemical Oceanography

Spring, 2 credits

NEIL R. ANDERSEN

Historical development of chemical oceanography. Basic concepts. Present status and specific problems relating to current studies. Interrelationship with other disciplines in oceanography. Origin of elements. Sea water composition. p^H and p^B . Nutrients. Dissolved gases. Radiochemical applications. Laboratory methods for marine chemistry. *Prerequisites*: Calculus and General Chemistry. General Oceanography desirable.

5-658. Geological Oceanography

Fall, 3 credits

MARTIN WEISS

Topography, composition, processes of sedimentation, and geologic history of ocean basins, continental shelves, and coastal features. *Prerequisite*: Professional knowledge of geology or oceanography.

5-546. Physics of Marine Atmosphere

Spring, 2 credits

ROBERT A. GILCREST

Meteorological observations and measurements at sea. Composition and properties of marine atmosphere. Its flow characteristics and thermodynamic processes, with emphasis on air-sea interaction. *Prerequisites*: Calculus and college physics.

5-520. Marine Geophysics

Fall, 2 credits

ROCKNE S. ANDERSON

Fundamental principles of geophysical measurements and interpretation, with emphasis on marine applications: Seismic refraction and reflection, earthquake seismology, gravity, geomagnetism including

paleomagnetism, and heatflow measurement. Study of shipborne instruments and methods from descriptive point of view. *Prerequisites*: Integral calculus and general physics. Background knowledge of geology desirable.

5-662. Marine Meteorology (1970-71 and alternate years)

Fall, 2 credits

M. D. BURKHART

Introduction to fundamental principles of marine meteorology with special emphasis upon problems of marine climatologist and physical oceanographer. Descriptive and synoptic meteorology. Air mass analysis. Boundary processes. Radiation. Climatic principles. *Prerequisite*: Professional knowledge of meteorology or oceanography.

5-706. Ocean Engineering

Fall, 3 credits

DAVID R. BRAUNSTEIN

Analysis and review of hardware, techniques, and major problems in each of following areas: Underwater vehicles. Energy sources and conversion. Materials. Environmental measurements. Auxiliary systems. Sensors. Diver technology. Seafloor construction. Test facilities. Ocean resource utilization. *Prerequisite*: General Oceanography, or equivalent, or bachelor's degree in physical sciences.

5-429. Oceanographic Remote Sensing

Fall, 2 credits

VINCENT E. NOBLE

Introduction to principles of remote sensing measurements in microwave, infra-red, visible, and near-ultraviolet portions of spectrum. Applications to biological and sea ice observations, and measurements of temperature, salinity, wave, and water color measurements.

5-664. Dynamic Oceanography

Fall, 2 credits

JOHN J. SCHULE, JR.

Introduction to principles of vector analysis. Development of principles of conservation of mass and momentum. Vector equations of motion. Hydrostatic equations and density-pressure-depth relationship. Various current equations. Principles of turbulence. Equation of mean motion. Various approaches to problem of evaluating eddy stress terms. *Prerequisite*: Physical Properties of Sea Water or equivalent.

5-666. Biological Oceanography

Year, 2 credits each semester

RENE P. CUZON DU REST and ANTHONY R. PICCILO

First semester: Principles governing distribution and ecology of microorganisms, plankton, and benthic organisms of sea. Discussion of productivity, food chain, and other topics. Second semester: Distribution, ecology, systematics, physiology, and behavior of marine benthonic invertebrates, fishes, reptiles, and mammals. *Prerequisite*: General Oceanography.

Public Administration

DEPARTMENTAL COMMITTEE

John H. Thurston, *Chairman*

Gladys L. Baker, Tony M. Baldauf, John C. Cooper, Jr., Erwin R. Draheim, Thomas J. Flavin, G. E. Hilbert, Max Hirschhorn, Martin Kriesberg, Harold H. Leich, William A. Minor

Public administration deals with the processes of operating government. As the Federal Government becomes larger and more complicated, it becomes more important to study and understand these processes in order to achieve effective administration of public programs.

CERTIFIED STATEMENTS OF ACCOMPLISHMENT IN PUBLIC ADMINISTRATION COMMITTEE

Gladys L. Baker, *Chairman*

Warner H. Hord, Martin Kriesberg, John H. Thurston

A student seeking a certified statement should consult with the Registrar so that he may be assigned to an advisor. An applicant for either certified statement must file a transcript of his high school or college record before completion of his program. When the student has completed 10 semester hours in public administration, he should review his course of study with the Registrar.

Programs for certified statements of accomplishment can be of value to:

1. Operating, technical, staff, and other personnel who now hold or are interested in advancing to positions involving managerial responsibilities.
2. Administrative staff personnel who wish to acquire a broader grounding in general management and administration as well as in their specialties.
3. Specialists and students in technical fields who want to broaden their understanding of government administration.

Transfer of credits. Courses taken at other institutions, equivalent to those required for either statement, may be accepted.

Honors. The student who has completed the requirements for the Undergraduate or Advanced Certified Statement of Accomplishment in Public Administration with an average grade of B or better may qualify for honors by passing an oral examination. The examination is given by a panel set up by the Graduate School. The student who wishes to take an oral examination should apply to the Registrar at the completion of his program.

Undergraduate Certified Statement of Accomplishment

Graduation from high school, or the equivalent is the minimum educational background required.

Requirements (40 credits)

1. 20 semester hours of credit with a grade of C or better in college level courses in the Social Sciences.

Required courses:

American or European Government, or Political Science
 Principles of Economics
 American or European History
 Introduction to Public Administration

These requirements may not be waived, but equivalent courses may be accepted by transfer from other institutions. With the approval of the Registrar, credit may also be given for 6 semester hours of tool courses relating to work in public administration. These may be in accounting, economics, statistics, writing, or a subject-matter area related to the work in which the student is employed.

2. 20 semester hours of credit with a grade of C or better in courses in public administration, excluding all accounting courses. These are to be distributed as follows:
 - a. 6 credits from Management and Management Analysis courses.
 - b. 14 credits from General Administration, Budgetary and Financial Administration, Legal Administration, Personnel Administration, Procurement and Property Management, or additional courses in Management. The student is advised to include courses in more than one area in his program.
 - c. Credit may be given for courses other than those in public administration with the approval of the Registrar. These courses should be in line with the major interest of the student. Not more than two courses may be from Office Techniques and Operations.

Advanced Certified Statement of Accomplishment

Requirements

1. An undergraduate degree, an Undergraduate Certified Statement of Accomplishment in Public Administration, or Government experience at the GS-12 level, or above. An introductory course in public administration or political science, or equivalent, is also required as a prerequisite.
2. 20 semester hours of credit with a grade of B or better, as follows:
 - a. A minimum of 5 credits in courses listed under General Administration.
 - b. 15 hours of credit in courses listed in the Department of Public Administration in courses 400 and above. With permission of the Registrar, 5 credits in other social sciences and not more than 3 credits in a course numbered under 400 may be substituted.

General Administration

COMMITTEE

Martin Kriesberg, *Chairman*

Gladys L. Baker, Mae C. King, Jack Koteen, A. J. Nichols, Robert J. Pitchell, Ward Stewart

These courses offer general understanding of American Government and administrative processes and provide a foundation for more specialized work in management and public administration. A student who plans to take courses in any of the specialized fields of administration will find that his work will be more meaningful and useful if he has first completed some of the background and basic courses listed here.

6-341. American National Government

Fall, 3 credits. Repeated in Spring

KATHERINE A. FREDERIC

History and origins of national Government of the United States. Political process: Parties and elections. Legislative process. Functions of national Government and their administration. Courts and judicial review of legislation.

6-344. Introduction to Public Administration

Fall, 2 credits. Repeated in Spring

LEWIS B. SIMS

Designed to introduce the student to elements of public administration and to lay the foundation for further study and practice in this field. Nature and scope. Management of public affairs. Contrasts and similarities in public and private management. Mechanisms and procedures for carrying out public function. Relationships of branches of government in United States. *Prerequisite:* American National Government, or equivalent.

6-523. State and Local Government

Fall, 3 credits

JOHN J. CALLAHAN

Designed to develop understanding of structure and process of state and local politics. Survey of executive, legislative, and judicial structure of state and local governments. Legal basis of state-local relations. Municipal home rule and decentralization of city governments. Metropolitan government. Budgetary politics of state and local governments and politics of intergovernmental fiscal relations. State and local role in urban development programs. Study of state-local intergovernmental relations in particular functional areas.

6-544. Political Parties

Fall, 3 credits

JOHN T. GRUPENHOFF

History, functions, and patterns of American political parties. Study of national, state, and local party organization, along with trends in electoral participation. Use of campaign techniques. Party organization as interested group. Functions and influence of various interest groups.

6-334. American Presidency

Fall, 3 credits

JON E. YELLIN

Historical origins and alternative approaches. Evolution of office. Selection process inclusive of changing campaign strategies. Executive growth and staffing. Powers and limitations of office. Presidential decision making process using case studies. Presidency compared.

6-515. Congressional Procedure

Fall, 2 credits. Repeated in Spring

DONALD E. DEUSTER

Legislative process in Federal Congress. Sources of legislation. Influence of political parties. Committee procedures. Floor action in House and Senate. Influence of executive, special interest groups, and public. History and organization of Congress. Life story of bill. Characteristics of Congressmen and Congressional offices.

6-400. Administrative Operations for Congressional Assistants

Spring, 2 credits

JEROME N. ELLER
MERRILL W. ENGLUND

Practical administrative problems encountered by secretaries and other staff assistants to United States Senators and Congressmen. Organization of office routine. Preparation and distribution of newsletters and publicity releases. Special services available to members of Congress. Use of Senate and House Documents and reports. Relations with the Executive departments. Pressure groups. Relations with constituents. Practical workings of Congress. Assistance with legislative matters.

6-355. Administration of Poverty and Hunger Programs

Fall, 2 credits

ANDREW S. ADAMS

Federal anti-poverty programs—their objectives and means employed to achieve them. Includes problems and procedures for working relationships between Federal, State, and local agencies concerned with these programs.

6-440. Metropolis: Government, Finances, and People

Fall, 3 credits. Repeated in Spring

PETER W. HOUSE and ASSOCIATES

Survey course for those interested in phenomenon of metropolitan growth. Approach from point of view of sociologist, economist, and political scientist. The student is introduced to current thinking in each of these fields as it relates to metropolitan growth. He is given opportunity to study some of these theories in light of practical problems encountered in a growing metropolitan area.

6-445. Civil Rights—Problems and Solutions

Spring, 3 credits

ROBERT J. COATES

Designed to develop understanding of and insight into problems facing minority group persons in our society. Problem background and analysis. Methods and techniques used in problem resolution. Analysis of specific problems in voting, education, employment, public accommodations, and housing. Evaluation of solutions to specific problems. Review of local and national, public and private agencies, and organizations at work in field.

6-507. Governing Science and Technology

Fall, 2 credits

WARREN H. DONNELLY

Survey of government in its relations with science and technology, focusing upon government support, fostering and application. Government control and regulation of science and technology. Leaders and landmark events. Congressional and executive branch organization. Government administration. Fostering of applications and resources. Public policy for science and technology. Advisory mechanisms and various approaches to dealing with unwanted side effects of applied science and technology.

4-201. Modern Supervisory Practice (See P. 58)

6-347. Principles and Practice of Management (See P. 78)

6-202. Management—Seminar (See P. 78)

6-453. Human Relations in Administration

Fall, 3 credits

JAMES M. ENNEIS

Designed to develop understanding of and insight into inter-personal relationships in large-scale organizations. Value orientations in administration. Formal and informal organization. Pathologies in administration. Status and role. Power and authority. Styles of leadership. Authoritarian and democratic administrators. Career dynamics. Psychological stress in administration. Motivation and morale.

6-454. Applied Human Relations in Administration

Spring, 3 credits

JAMES M. ENNEIS

Practice in applying principles of human relations in administration. Diagnoses of social processes in administration. Skills of effective performance in face-to-face situations. Formulation and assignment of administrative objectives. Creation of appropriate social climate. Leadership skills. Utilization of member resources. Irrational factors in administration. Decision-making processes. *Prerequisite:* Human Relations in Administration, or special permission.

6-600. Readings in Public Administration

Fall, 3 credits. Repeated in Spring

JOHN H. THURSTON, Coordinator

Supervised readings with monthly conferences on specified topics of administration or individual research and a paper on some problem or phase of administration, under the guidance of a senior administrative official. Readings or problem to be investigated determined in consultation with adviser. *Prerequisite*: Completion of all other requirements for Undergraduate or Graduate Certified Statement of Accomplishment in Public Administration, or by special permission with equivalent background in public administration.

American History

6-250. American History To 1865

Fall, 3 credits

WAYNE D. RASMUSSEN

Political, social, economic, and cultural forces prior to 1865, contributing to development of American civilization. Summary of colonial period. Political, economic, and diplomatic factors of American Revolution. Development of national life and institutions.

6-251. American History Since 1865

Spring, 3 credits

WAYNE D. RASMUSSEN

Political, social, economic, and cultural forces since 1865, contributing to development of present-day American civilization. Frontier movement and immigration. Constitutional growth and changes in world relations. Economic change and development.

6-255. West in American History

Fall, 3 credits

JAMES CARSON

Frontier as watershed between European and American civilizations. Westward movement from original colonies to Pacific Coast, with emphasis on trans-Mississippi West. Political, social, and cultural transition in newly-settled regions of American West. Myth, folklore, and reality among Indians, trappers, cattlemen, and settlers. Influence of frontier society on American life today.

Management and Management Analysis

COMMITTEE

John C. Cooper, Jr., *Chairman*

Ronald Brand, J. Elton Greenlee, Robert E. Hall, Leo Herbert, Arthur B. Jebens, Kimball Johnson, Mark M. Kirkham, William F. Rapp, Harold A. Stone

Management has tremendous influence on the administration of Federal programs, on the adaptation of these programs to public needs, and on the quality of service to the public. A growing body of knowledge is available for study and application in the management of organizations. The vigor with which this knowledge is adapted depends mainly on how well the manager understands modern management practices and on how great is his skill in using them in his organization.

Management analysts in the Federal agencies serve as staff assistants to managers in raising the level of efficiency and effectiveness of organization through the introduction of better management concepts, systems, and practices. This is frequently accomplished through management analysis and systematic study of problems in the direction, coordination, and control of the organization. Management analysts must be

skilled in concepts of techniques of analysis applicable to a wide range of management problems. They must possess theoretical knowledge about the field of management and must have had extensive opportunity for practice.

The courses outlined below cover various aspects of the general field of management, as well as the analytic and related organizational skills required of management analysts.

6-347. Principles and Practice of Management

Fall, 2 credits

RICHARD E. BALLARD

Knowledge and managerial responsibilities that distinguish professional managers from other professional personnel, in terms of both theory and application. Principles of planning, organizing, directing and controlling, and their application as encountered in public administration. Development and discussion of ways by which these management principles can be used by class participants in executing their supervisory responsibilities. *Prerequisite:* Supervisory work experience at Grade GS-9 or above, or special permission.

6-405. Principles and Techniques of Management Analysis

Year, 3 credits each semester

JAMES W. GREENWOOD, JR.

Comprehensive introduction to subject of management systems, their analysis, and improvement. Emphasis on systems approach to management and on role of management analyst in identifying and solving problems of manager in organization and management of government agencies. Designed for beginning management analyst, manager, and supervisor desiring some acquaintance with techniques, and senior management analyst desiring refresher course. *Prerequisite:* Introduction to Public Administration, or equivalent training or experience.

6-414. Management and Organization Studies: Case Critiques

Fall, 2 credits

WILLIAM F. RAPP and ASSOCIATES

Exposition and critique of selected actual studies and surveys of complex management and organization questions. Cases conveying effective ways to organize and conduct involved study efforts. Concepts and techniques used in planning study, designing analytic framework, gathering data, reaching conclusions, and preparing report, as well as such considerations as client relationships, selling and implementation—all under variety of study conditions. Wide range of important organization structure and management system problems. Each case presented by senior management analyst thoroughly familiar with study. Offered in cooperation with Agency Management Analysis Officers Group, from whose membership useful case experiences are selected.

6-409. Conduct of Management Surveys

Spring, 2 credits

WILLIAM S. DINSMORE

Methods useful in management surveys, with emphasis on techniques required in fact-finding, logic necessary in analysis, and "selling" required in presentation of recommended solutions for identified problems. Study of comprehensive management survey including, but not limited to, reconnaissance, organization, functional, procedural, and special purpose surveys, survey workshops, and case studies. Consideration of useful approaches and problems inherent in successive stages of both general purpose and problem-solving surveys. Designed to give journeyman analyst opportunity for advancement in field of management analysis. *Prerequisite:* Experience in management surveys, or special permission.

6-202. Management—Seminar

Fall, 3 credits

WILLIAM R. VAN DERSAL

Designed for those managing an organization or organizational segment involving subordinate supervisors. Review of basic elements of management. Study of management systems useful

in organizations, including systems of career development, training, communications, supervisory development, and administrative control. Reviews of management literature and professional journals. *Prerequisite:* Modern Supervisory Practice, or Grade GS-9, or above.

6-511. Quantitative Approaches to Management Problems

Fall, 3 credits. Repeated in Spring

JOHN MOUNDALEXIS

For the student desiring working knowledge of practical quantitative techniques for solving complex management problems. Structure and applications of systems planning, control, and analysis techniques, such as sampling, queuing, linear programming, line of balance, correlation and regression analysis, probability and statistics, inventory theory, and simulation. Definition of problems dealing with cost-benefit/cost-effectiveness/benefit to society and trade off relationships for resources and values of total or partial organization. Development of these problems and interpretation of results. Clinic session on student problems. Analyses and discussion.

6-470. Management Information Services: Concepts, Responsibilities, and Uses

Fall, 2 credits

HAROLD ROSENTHAL

Designed to introduce the student to management information services providing socio-economic and program data to administrators, staff, other officials, and the public. Principles and standards for compiling, cataloging, correlating, analyzing, and reporting such data on timely basis to meet needs of management of enterprise. *Not* about public relations, computers, or data processing.

6-459. Executive Staffwork

Fall, 3 credits

ALVIN J. HURT

New dimension for executive-level staff work, based on implications of behavioral findings. For experienced staff specialists and chiefs of staff offices. Appropriate for all staff specialties: Budget and accounting, management services, personnel, planning, supply, and others. Staff role in modern management. Improving staff-line collaboration. Emphasis on visual tools, consultative approaches, and innovation. "Executive staff method" in management decision-making process. Illustrated by graphic materials used in designing career system in large Federal agency. Practice and critique in preparing and making presentations on selected management problem from work situation of the student.

6-519. Work Standards and Work Measurement

Fall, 2 credits. Repeated in Spring

SIDNEY SCHNEIDER

Advanced techniques of scientific management concerned with development of work standards and measurement of work loads and performance, and of their adaptability in public administration. Statistical and experimental methods of determining standards. Dangers to avoid in setting standards. Time study. Standards as dynamic part of operations and tool in developing policies on personnel placement and training. Standards as aids in developing budgets, in planning operations, and in individual work planning. Relationship of standards of performance to those of costs and quality. Importance of dependable standards, measurement, and appraisal of performance to summary statements of progress for the use of higher administrative officials. *Prerequisite:* Practical working experience at Grade GS-7 or above, or special permission.

6-550. Techniques of Organization

Spring, 3 credits

INSTRUCTOR TO BE ANNOUNCED

Organization of public and private agencies. Historical review as background for study of organization in modern society. Structural-functional approach of scientific management. More modern approach of behaviorists. Formal versus informal organization relationships. Staff and line responsibilities and authority. Group participation. Decentralized versus centralized organizations and their operation. Administrative leadership and reorganization. Charts and manuals.

6-521. Management Innovations in Intergovernmental Relations

Fall, 2 credits

RONALD BRAND

Designed to review briefly past and current institutional developments in Federal-State-local relationships and recent Congressional enactments, including Intergovernmental Cooperation Act of 1968. In light of this background, exploration and evaluation of current developments in individual Federal agencies, Bureau of the Budget, and Congress to introduce and carry out management innovations. The student develops one or more case studies for class presentation and discussion based on developments in his own or other Federal agencies, Bureau of the Budget, or ACIR.

6-522. Executive Decision Making

Fall, 2 credits

JOHN H. FINLATOR

Designed for those at junior- and middle-management levels who wish to improve their effectiveness as executives through better understanding of art of decision-making. Specifically intended for those at level of branch and division chief in Federal establishment, or equivalent in private sector. Developed to help agencies and companies in junior- and middle-executive development programs. Includes in depth, but not limited to: Creative process. Use of premises. Mathematics in decision-making. Role of authority and leadership. Gaining acceptance of decisions. Planning and putting into effect decisions. Executive behavior.

6-524. Program Planning and Control—Developing and Controlling Agency Programs

Fall, 3 credits

INSTRUCTOR TO BE ANNOUNCED

Designed for middle- and top-level management and staff assistants wishing to obtain understanding of theory, structure, and procedure for building and controlling agency programs during development and execution. How to convert agency objectives into programs for short- and long-range action. Process of conceiving and initiating program, as well as scheduling and controlling it financially, quantitatively, and qualitatively. Identification of programming as one element of agency's management system. Evaluation of alternatives within agency's corporate structure. Appraisal of effect of environment, politics, and social and economic forces on agency programs. How agency head selects from alternatives and puts priorities on elements of program based on cost effectiveness studies. Techniques of displaying and selling programs to higher authority, including Congress. Latest concepts and techniques for making plans, structuring programs, selecting and obtaining information for measuring program performance and making adjustments to programs to accommodate changing situations.

6-513. Network Systems for Project Management

Fall, 3 credits. Repeated in Spring

KENNETH F. SMITH

Designed to give the student working knowledge of three major network systems: PERT, CPM, and Line of Balance. Their use as systematic approach to management of large and complex programs and projects. Program breakdown structure. Network construction. Time estimating. Probability. Network computation. Critical path analysis. Scheduling. Reporting. Computer utilization. Time/cost optimization. Forecasting and monitoring of projects. Claims analysis.

6-415. Statistical Science in Management

Spring, 3 credits

BENJAMIN J. MANDEL

Designed for management personnel, management and system analyst, cost and budget officer, supervisor, accountant, and auditor. Use of statistical methods such as averages, standard deviations, control charts, and sampling in establishing work measurement and management control systems. Cost estimation. Auditing. Forecasting. Production control and quality control. Numerous applications to practical problems of management, including ten case studies of measurement and analysis. Background in statistics and sampling desirable.

- 3-310. Introduction to Probability Theory (See P. 43)
- 3-532. Introduction to Linear Programming (See P. 44)
- 3-533. Mathematical Programming (See P. 44)

Personnel Administration

COMMITTEE

Harold H. Leich, *Chairman*

John D. R. Cole, Jack H. Foster, C. O. Henderson (*Vice-chairman*), Henry F. Hubbard, Fordyce Luikart, George S. Maharay, John A. McCart, James K. Sullivan, Arthur L. Tackman, John A. Watts

These courses should be of concern to the Federal employee who is interested in a career in management. Some knowledge of the principles of public administration, such as can be acquired from the introductory course in public administration, is helpful although not required. It is also desirable that the general course, Public Personnel Administration, be taken before the specialized courses such as Position Classification, Employment and Placement, and the like. The student who is in a position classified at Grade GS-5 or below and who desires to prepare for personnel work should first take the course in Federal Personnel Procedure in the Department of Office Techniques and Operations. The interested student should not attempt to take any specialized courses until he has gained substantial experience in personnel work or has completed all the basic general courses.

- 4-114. Federal Personnel Procedure (See P. 59)

6-430. Public Personnel Administration

Fall, 3 credits. Repeated in Spring

GEORGE S. MAHARAY and CHARLES E. WEITHONER

Designed for the supervisor and administrator who wish to have general familiarity with personnel work, for those in junior personnel staff positions desiring to broaden their understanding of personnel administration, and for those desiring to enter the field who need a foundation for more specialized courses in the personnel field. Primary emphasis on theory and practice of personnel administration in the Federal Government. Development and significance of personnel administration in public service. Recruitment, examination, and selection. Classification and pay concepts. Employee organizations, motivations, and training. Conduct and discipline. Role of Civil Service Commission, operating agencies, and their personnel officers. Personnel responsibilities of supervisors Trends in personnel administration.

- 4-201. Modern Supervisory Practice (See P. 58)

6-432. Management-Employee-Employee-Management Communications

Fall, 2 credits

ERWIN R. DRAHEIM

Designed for employee, supervisor, and administrator who wish to develop understanding and insight into positive, open channels of communication. Between supervisors and employees. Between

employees and management. How to get through to the boss. As a supervisor how do you get and stay in focus with your employees? How to communicate up and down. How to instruct so it takes. How people differ and what supervisors need to do about it. How to instruct new employees. How to instruct old employees for new jobs in age of rapid technological change. Actual cases. Active participation by members of group.

6-436. Management-Employee-Employee-Management Motivation

Spring, 2 credits

ERWIN R. DRAHEIM

Designed for employee, supervisor, and administrator who wish to develop understanding in depth and insight into proven and practical ways to motivate people. What makes people tick? What turns them on? How to motivate so it takes. What brings people out of rut and pushes them ahead? How to develop best potential in each person. How motivation generates sense of accomplishment. Why are some people doers, get things done? Others do not. How motivation works up and down. How to motivate boss who in turn motivates you. Management's role in motivation. As supervisor, how to zero in and stay in focus with employees. How and why people react differently to motivation and what supervisors can do about it. How to motivate new employees. How to motivate old employees for new jobs in age of rapid technological change. Actual cases. Active participation by members of group.

6-395. Employee-Management Cooperation in Federal Service

Fall, 2 credits

DANIEL E. MATTHEWS

Highlights of union-management relations in United States. Development of collective bargaining. Events leading to Executive Order 10988. Analysis of Order. Federal experience since 1962. Operational problems. Impact of program. Relationship to other aspects of personnel management. Administering labor-management relations.

6-473. Employee Benefits: Health and Insurance Plans

Fall, 2 credits

DONALD M. LANDAY and JOSEPH ZISMAN

Role of health and insurance plans as supplementary compensation practices in industry and government. Scope, characteristics, prevalence, and regulation of group insurance. Sick leave, annual leave, and workmen's compensation. Structure of group life insurance, health insurance, and disability insurance. Underlying principles, practices, and problems in design and administration of such plans, with specific reference to Federal Government programs.

6-474. Employee Benefits: Retirement Plans

Spring, 2 credits

DONALD M. LANDAY and JOSEPH ZISMAN

Role of pension and deferred profit sharing plans as supplementary compensation practices in industry and government. Their scope, characteristics, prevalence and relationship to Social Security benefits. Fundamentals of funding, design and administration. Federal regulation and taxation of private plans: Existing and proposed.

6-305. Systems Safety Management

Fall, 3 credits

HAROLD M. GORDON

Designed to present systematic body of knowledge concerning establishment, measurement, and appraisal of systems, methods, and programs for identifying, analyzing, and removing causes of accidents having adverse effect on best utilization of manpower and property. Theory and management of systems as related to accident prevention techniques. Methods for maximum utilization of various systems and subsystems of management (personnel, finance, legal, property, and other) into integrated total management approach. New concepts of error-free performance related to work errors, equip-

ment failures, systems weaknesses, and related operating problems that generate accidental loss. Utilization of behavioral science principles for group problem solving. Use of automatic data processing to identify system deficiencies.

6-450. Systems Safety Management: Seminar

Spring, 3 credits

HAROLD M. GORDON

Discussion and exchange of ideas relating emerging concepts of safety management. Relationship of error and accident causation factors and functional components of management system such as personnel, procurement, training, maintenance, and engineering. Emphasis on practical approaches of accident prevention to aid management decision making in achieving cost reduction and improved manpower utilization. Other techniques including systems safety, critical incidence, and safety sampling. *Prerequisite:* Systems Safety Management, or special permission.

7-446. Personnel Psychology

(See P. 100)

6-444. Position Classification

Fall, 2 credits. Repeated in Spring

ROBERT D. PITCHER and WILLIAM H. WESP

Basic concepts and uses of position classification relating to total Federal personnel management process. Designed for position classification trainees, personnel assistants, and personnel management generalists. "How-to-do-it" format. Useful for employees occupying administrative management or supervisory positions desiring to become better informed about their personnel management responsibilities. Brief history of classification legislation. Role of classification in total management process. Bases for classifying general schedule positions and jobs under Coordinated Federal Wage System. One-half of class sessions devoted to fact finding, describing, documenting, evaluating, and classifying positions.

6-447. Advanced Position Classification

Fall, 2 credits

ROBERT J. MCCARTHY and HAROLD SUSKIN

Designed to explore advanced position classification techniques and relationship between position classification and other personnel management functions. New developments in field of job evaluation and wage and salary administration, with particular emphasis on impact on Federal Government. Defining role of position classification as part of total management process. Case problems and group discussions. Class lectures and guest speakers. Open to personnel specialists.

6-512. Employment and Placement

Fall, 3 credits. Repeated in Spring

PAUL B. LORENTZEN and ASSOCIATES

Staffing in Federal service, covering both general principles and background as well as specific programs and applications. Manpower picture, manpower planning, and utilization. Qualification standards. Recruitment. Examining, testing, and selection. Promotion and other placement actions. Special interest employment areas. Relationship to other major personnel management functions. Class participation and mid-term paper. Assumes basic course or working experience in personnel management.

6-518. Employee Training and Development

Spring, 3 credits

STANLEY GOLDBERG

Application of systems approach to development of human resources through current, efficient, cost-effective training actions. Analyzing and determining training needs. Costing, designing, and evaluating training programs, including orientation, industrial, administrative, professional, technical, and supervisory. Career and organization development. Organizing and staffing training function. Practice exercises in instructional development.

6-520. Manpower Planning and Utilization

Fall, 2 credits. Repeated in Spring

FRANK G. JOHNS and ASSOCIATES

Nature and purpose of manpower planning. Reasons for current emphasis on manpower planning, utilization, and control. Relation to traditional personnel administration. Relation to budgeting. Integrating manpower planning and utilization into total planning and management process. From work plans to estimates of manpower needs. Uses of estimates. Optimum utilization of manpower. Manpower controls. Developing and administering manpower plan.

6-441. Improving Personnel Management with ADP

Fall, 2 credits

INSTRUCTOR TO BE ANNOUNCED

Designed for personnel management specialists with limited knowledge of computer processing techniques applied to personnel management. Current uses of computers in government and industry. Advanced systems concepts for improvement of personnel management through computer-based information systems. Pragmatic step-by-step approach.

6-451. Personnel Management for Supervisors

Fall, 3 credits

ANTHONY W. HUDSON

Practical approaches for first- and second-line supervisors to enhance communication and maintain effective relations with employees as well as personnel staff. Class case studies drawn from actual experience of participants. Writing meaningful job sheets. Flexibilities in appointment system. Determining and responding to training needs. Utilizing skills. Equal opportunity in thought and action. Discipline. Employee relations. Primary emphasis on current Federal policy and programs, with examination of influence or related behavioral and management disciplines.

6-453. Human Relations in Administration (See P. 76)**6-454. Applied Human Relations in Administration**
(See P. 76)**7-545. Counseling Techniques** (See P. 102)**7-547. Counseling and Behavior Modifications** (See P. 102)**Legal Administration****COMMITTEE****Thomas J. Flavin, Chairman**

Dorothea A. Baker, Harold M. Carter, Anthony L. Mondello, Leo M. Pellerzi, David Reich, Ashley Sellers

6-320. Administrative Law and Procedure

Fall, 2 credits

THOMAS J. FLAVIN

Principles and practice of administrative law in the Federal field with concentration upon provisions of Administrative Procedure Act (1946) dealing with formal rule-making and adjudication and involving notice, hearing, evidence, findings, and control by the courts.

6-422. Business Law

Year, 2 credits each semester

ELMER MOSTOW and JOHN A. HARRIS

Aspects of law essential to conduct of modern business. Forms of business organization, bailments, property, sales, mortgages, negotiable instruments, and contracts. The student may attend either or both semesters. No subject matter repeated.

6-503. Law for Government Managers

Fall, 2 credits. Repeated in Spring

ELMER MOSTOW

Aspects of Federal law (civil and criminal) critical to government managers and their subordinates in management of Federal establishment. Authorities and limitations imposed by law covering employment, discipline, pay, and benefits in Federal service. Obtaining appropriations and using obligations and expenditures, personal and official authority, or responsibility and liability. Designed to give Federal managers awareness of laws affecting their day-to-day operations. *Prerequisite:* Grade GS-7, or above, or special permission.

6-424. Unlawful Selling Practices

Fall, 2 credits

ROBERT E. DUNCAN

Deceptive and unfair marketing practices in sales to individuals. Consideration of such practices as bait and switch, loss leader, credit abuse, false advertising including pricing and labeling and deceptive packing as covered under Federal laws. Consideration of laws designed to guard purchasers without major emphasis on technical statutory and regulatory requirements.

6-426. Legal Elements of Sale, Rental, and Purchase of Property

Spring, 2 credits

ROBERT E. DUNCAN

Survey of laws and practices applicable to transfer of property ownership, including personal property and real property. Financial and contractual aspects of acquiring property. Designed for the student seeking general knowledge of problems attendant to acquisition and disposition of property without major emphasis on technical requirements.

6-425. Legal Aspects of Investigation—Criminal Evidence and Procedure

Spring, 2 credits

ROBERT E. DUNCAN

Designed to provide investigative personnel and those desiring to prepare for such work, background and insight into legal aspects of their investigations. Types of evidence to seek. Circumstances and conditions under which the evidence is to be obtained in order to have adequate probative value. How to prepare such evidence for presentation in court or for other procedure. Designed to provide understandable information without overemphasis of technical aspects. *Prerequisite:* Sufficient educational background for appointment to training position in investigational work.

6-471. Legal Protection of Scientific and Industrial Property

Fall, 2 credits

JAMES A. CURLEY

Survey of various means of legally protecting scientific and technological innovations under law of ideas, patents, and trade secrets. Emphasis on proper steps technical personnel should take in protecting their inventions, including techniques for recognizing inventions, adequate record keeping, and confidential disclosure. Outline of patent system contrasted with law of trademarks and copyright.

6-705. Computer Uses in Law

Fall, 3 credits

PAUL R. BEATH

Recent developments in computers and information processing as aids to legal process. Problems created. Searching of statutes at State and Federal levels. LITE program of United States Air

Force, Aspen System. Federal tax applications. Internal Revenue Services, tax policy, and taxpayer returns. Patent problems. Computer utilities. Criminal law and police methods. Guest speakers. *Prerequisite*: Knowledge of data processing helpful, but not essential.

2-145. Law Librarianship (See P. 32)

6-370. Government Construction Contracts (See P. 86)

6-371. Government Construction Administration (See P. 87)

Procurement and Property Management

COMMITTEE

Tony M. Baldauf, *Chairman*

Conrad L. Trahern, George J. Vecchieti, L. Don Williamson

These courses examine the ways in which the Federal Government purchases, manages, and accounts for materials and supplies. The student interested in purchasing but with limited experience in such work will find it helpful to start with the courses in Federal Property Procedure and Federal Purchasing Procedure in the Department of Office Techniques and Operations. Selected background courses in public administration together with courses in the Division of Management Analysis offer thorough training in administration in this area.

4-113. Federal Property Procedure (See P. 59)

4-115. Federal Purchasing Procedure (See P. 59)

6-364. Federal Contracting

Fall, 2 credits. Repeated in Spring

HENRY A. BAUER, III
DEAN T. SMITH

Primarily for employees of civilian agencies using Federal Procurement Regulations. Contracting as technique of purchasing where advertising is required, including study of legal and administrative policy background of contract provisions, requirements of advertising, analysis of bids, contract award and administration, handling of disputes, appeals, protests, change orders, amendments, set-asides, labor standard matters, debarment procedures, and related subjects. Practical application by preparation of bids, contracts, orders, and related matters. *Prerequisite*: Federal Purchasing Procedure, or current experience in purchasing or contracting.

6-370. Government Construction Contracts

Fall, 2 credits

PAUL H. GANTT, MOODY R. TIDWELL, III, and ASSOCIATES

Government contract law, with special emphasis on construction contracts. Principles of Government contract administration. Study of contract general and special provisions. Administration of Davis-Bacon Act, Miller Act, and other laws pertaining to construction contracts. Handling of contract modifications, changes, suspension of work, and damages. Study of landmark cases in courts, with decisions of Appeal Boards and Comptroller General. Case problems. *Prerequisite*: Experience in purchasing or contracting.

6-371. Government Construction Administration

Spring, 2 credits

PAUL H. GANTT, MOODY R. TIDWELL, III, and ASSOCIATES

Consideration of complicated problems of recurring nature in Government construction administration. Study of landmark cases. Tracing of problems from inception to disposition by contracting officers and review authorities. Contract appeal boards and litigations in courts. Seminar discussion, with written materials. *Prerequisite:* Government Construction Contracts, or special permission.

6-374. Research and Development Contracting

Fall, 2 credits. Repeated in Spring

ROBERT J. BURNS

Basic course in procedures and policies of Federal Government in field of research and development contracts. Organization for research and development. Life cycle. Methods of contracting. Administration of contracts. Management of and rights in data. Cost and pricing. Consideration of some special problems in research and development. *No previous knowledge of or experience in government contracting necessary.*

6-638. Government Defense Contracts

Year, 2 credits each semester

EUGENE J. DAVIDSON

Survey and analysis of defense contracts, procurement policies, procedures, and contracting methods. Review of Armed Services Procurement Act, Armed Services Procurement Regulation, other applicable laws and regulations, and decisions of Armed Services Board of Contract Appeals, Comptroller General, Court of Claims, and United States Supreme Court. Contracting by formal advertising and negotiation. Fixed price. Cost reimbursement and incentive-type contracts. Change orders and supplemental agreements. Contract termination (default and convenience). Price re-determination and escalation. Renegotiation. Assignment of claims. Contract financing bonds, labor standards, taxation, contingent fees, and conflicts of interest. Government-furnished property and special relief legislation (P.L. 85-804, and others).

6-565. Inventory Management

Fall, 2 credits

EMANUEL M. SILVERMAN

Principles and practices, with emphasis on ways and means to reduce supply operating costs, investment in inventories, and paperwork processing costs. Defining inventory management objectives. Application of financial management techniques. Methods of maintaining stock records. Stock replenishment systems and procedures. Criteria for stockage. Determining supply operational costs. Federal standard requisitioning and issue procedure. Procedures for conducting physical inventories. Supply management reporting. Opportunities for automation in inventory management.

6-502. Computer Equipment Selection

Fall, 3 credits. Repeated in Spring

EDWARD O. JOSLIN

Designed for those involved with acquisition of major pieces of equipment through competitive bidding situation. Applicability of some selection techniques developed in field of computer selection to other types of equipment acquisition. Equipment specifications *vs.* application specification. Mandatory and desirable capabilities. Selection plans. Validation techniques. Evaluation techniques. Scoring methodologies. Procurement considerations. To prepare the student to take active and meaningful part in activities involved with equipment acquisition and to provide him with knowledge necessary to make management decisions preceding actual acquisition. *Prerequisite:* Adaptability to case method of learning.

8-405. Principles of Specifications

(See P. 110)

Accounting and Financial Management

COMMITTEE

Max Hirschhorn, *Chairman*

Paul L. Appleman, William J. Armstrong, William L. Campfield, Robert H. Fuchs, Charles L. Grant, Warner H. Hord, James F. Kelly, W. Fletcher Lutz, Charles N. Mason, Sr., Sidney S. Sokol, Carl W. Tiller

Financial management, budgetary control, and accounting team together to supply the basic tools of modern management, whether applied to governmental institutions or to private enterprise. Financial management and budgetary control provide the plans, programs, and end objectives toward which a government or business enterprise directs its efforts. Accounting provides the means to measure, assess, and evaluate the actual results achieved from putting the plans and program in operation, to compare factually the actual results with these plans, and finally to identify the nature and cause for variances between the two.

The scope and range of activities requiring skills in financial management and accounting within the Federal Government are very wide. The need for these skills has developed from the joint financial and management improvement program in the Federal Government, as well as from the rapidly increasing need for greater management skills. As the size and diversification of activities increase, new and more highly developed management and accounting skills are necessary to the efficient and economic performance of these activities and to assure that the public receives full value for the money expended. Hence, the basic purpose of these skills within the Federal Government is to give the President better financial management in the Executive Branch, the Congress better information for acting upon appropriations and other legislation, and the public a clearer picture of financial conditions in operations of the Federal Government.

CERTIFIED STATEMENTS OF ACCOMPLISHMENT

Certified statements of accomplishment may be earned in the fields of accounting and financial management. Each of these certified statements requires a comprehensive program of study to be developed, giving a broad understanding of the basic economic objectives toward which each program is directed. Sufficient specialization in the particular field is required to give a high degree of expertness in the planning, direction, and implementation of the particular program.

CERTIFIED STATEMENT OF ACCOMPLISHMENT IN ACCOUNTING

The program leading to the Certified Statement of Accomplishment in Accounting is broad enough to cover not only the regular appropriation and fund accounting of the Federal Government, but also the accounting training needed for many other governmental activities. The program is comprehensive enough both to provide advanced training for the Government service, and, if courses are carefully selected, to meet the usual educational requirements for Certified Public Accountant examinations. The student planning to take a Certified Professional Accountant examination should know the requirements of the State in which he plans to take the examination. In general, the course of study, in addition to accounting, should include the following: Business English, Business Law, Corporation Finance, Investments, and Principles of Economics.

Requirements (36 credits)

1. Graduation from high school, or the equivalent.
2. 36 semester hours of credit with a grade of C or better, as follows:

- a. Required courses (24 credits):
 - Principles of Accounting (6)
 - Intermediate Accounting (6)
 - Cost Accounting (3)
 - Advanced Accounting (6)
 - Principles of Auditing (3)
- b. Electives (12 credits):
 - Analysis and Interpretation of Financial Statements (2)
 - Business Law (4)
 - Cost Accounting (Second Semester) (3)
 - Federal Budget Administration (2)
 - Federal Financial Administration (2)
 - Federal Government Accounting (4)
 - Federal Income Taxes (6)
 - Principles of Economics (6)
 - Writing Procedures and Instructions or Official Writing (2)

A student seeking the certified statement should consult with the Registrar and obtain approval of his proposed course of study early in his academic program. He must file a transcript of his high school or college record before completion of his program.

ADVANCED CERTIFIED STATEMENT OF ACCOMPLISHMENT IN FINANCIAL MANAGEMENT

The program leading to the Advanced Certified Statement of Accomplishment in Financial Management offers an organized program of study for the advanced student designed to provide an understanding of the basic substance and public policy aspects of financial management. The program should be of interest to government personnel well advanced in the fields of accounting and budgeting and to program administrators who need a better understanding of the policy aspects of financial management

Requirements (20 credits)

1. An undergraduate degree. This requirement may be waived when the student can demonstrate that he has breadth of knowledge equivalent to such a degree or has completed 10 semester hours of credit with a grade of B or better from the courses listed below.
2. Completion of Basic Accounting—Concepts of Terminology, or demonstration of equivalent understanding of accounting. A working knowledge of accounting is desirable.
3. 20 semester hours of credit with a grade of B or better.

The following courses are required unless the student has had equivalent courses in other institutions.

- Federal Budgetary Administration (2)
- Introduction to Public Administration (2)
- Public Finance (3)

A minimum of 10 semester hours of credit are to be selected from the following courses.

- Analysis and Interpretation of Financial Statements (2)
- Audit Management—Seminar (4)
- Conduct of Management Surveys (2)
- Cost Accounting (3)
- Federal Budgetary Procedure: Formulation and Presentation (2)
- Federal Budgetary Procedure: Execution and Fund Control (2)

- Federal Financial Administration (2)
- Federal Income Taxes (6)
- Principles and Practice of Management (2)
- Statistical Sampling for Financial Management (3)
- Work Standards and Work Measurement (2)

A maximum of 3 semester hours of credit are to be selected from the following courses.

- American National Government (3)
- Human Relations in Administration (3)
- Legislative Process (2)

A student seeking this certified statement should consult with the Registrar and obtain approval of his proposed course of study early in his academic program. With the approval of the Registrar, courses in public administration or the social sciences may be substituted for those on the elective list. Equivalent courses will be accepted by transfer from other institutions. The student must file a transcript of his college record before completion of the program.

- 4-112. Federal Fiscal Procedure (See P. 58)
- 4-116. Federal Budgetary Procedure: Formulation and Presentation (See P. 59)
- 4-118. Federal Budgetary Procedure: Execution and Fund Control (See P. 59)

6-525. Federal Financial Administration

Fall, 2 credits

JAMES D. BURRIS

Federal financial system and its basis. Roles of major participants (Congress, President, Department of Treasury, General Accounting Office, Bureau of Budget, and operating departments). Contributions of each phase of financial management—budgeting, accounting, financial reporting, and auditing. Policies, principles, and practices followed. Progress and recent trends in financial management, including current developments to serve needs of planning-programming-budgeting systems and new budget concepts. *Prerequisite:* Bachelor's degree, or experience at Grade GS-9, or above, in financial or general administration, or special permission.

6-635. Federal Budgetary Administration

Spring, 2 credits

GERALD MURPHY

Federal budgeting from advance program planning through execution of budget. Principles and policies. Budgets as instruments of Congressional control and executive management. Relationships of budgeting to other aspects of financial and general management. Interrelationships in planning, programming, and budgeting systems. Changing nature of budgeting. Budgeting as means of public policy decision-making. Organization and management of budget staff. *Prerequisite:* Bachelor's degree, or experience at Grade GS-9, or above, in financial or general administration, or special permission.

6-342. Basic Accounting—Concepts and Terminology

Fall, 2 credits

CHARLES J. STRATTON

Survey course designed to provide administrators, economists, lawyers, scientists, and other non-accountants with working knowledge of concepts and terminology of basic accounting. Major principles and conventions of accounting. Nature and purpose of internal controls. Relationships of

accounting and taxation. Cost data and other special areas. Equips non-accountant with understanding of basic techniques of financial statement analysis and interpretation. *Not accepted for credit toward Certified Statement of Accomplishment in Accounting.* *Prerequisite:* Work experience in non-accounting position at Grade GS-11, or above, or special permission.

6-343. Statistical Sampling for Financial Management

Fall, 3 credits

BENJAMIN J. MANDEL

Practical nonmathematical course in elements of probability sampling as applied to financial management problems. Designed for those who collect and analyze quantitative information, including management analysts, systems analysts, personnel in accounting, auditing, and financial management positions in Federal Government, business, and industry. Basic principles and concepts of probability sampling, methods of sampling, sample size determination, estimation, and measurement and control of accuracy of estimates. Solution of specific problems encountered in fact-finding and quantifying. Minimal mathematical and technical derivations. *Prerequisites:* Background in statistics and sampling desirable.

6-46. Review for GS-510 Accounting Examination

Fall, non-credit. Repeated in Spring

FRANK E. SKINNER

Designed to review and prepare for examination for GS 5-7 and GS 9-12 grades in 510 Professional Accountant series. Presentation includes background and simulated problems and questions from GS-510 examinations on all accounting subjects. The same examination is given to both groups with a lesser average required of the GS 5-7 group. The Civil Service Commission gives this examination every month, and the student will be prepared to take the examination at the conclusion of either of the 8-week periods.

ELIGIBILITY: Non-competitive examination—GS-510 accounting position: The student is eligible if his Accounting Officer makes the request through his agency personnel office and if the personnel office is agreeable. *Minimum prerequisite:* Principles of Accounting, or equivalent.

Competitive examination: The student should either not be employed in a GS-150 accounting position or be employed outside the Federal Government. *Prerequisites:* (1) 24 semester hours in accounting and auditing required, (2) three years progressive experience providing knowledge and skills equivalent to those acquired in four years of academic study with accounting major, (3) any time-equivalent of (1) and (2).

6-352A. Principles of Accounting—First Half

Fall, 3 credits. Repeated in Spring and Summer

PAUL S. CARTER
MAX HIRSCHHORN
RAYMOND A. LUCAS
DANIEL E. PALENSKI
HOMER McMILLAN
BERNARD H. ROSENBERG
WILLIAM V. SITKO
ANDREW TRONOLONE, JR.
SUSUMU UYEDA

Elementary principles of accounting. Discussion and problems. At the end of the semester, the student is prepared to do accounting necessary for a small business organization; *i.e.*, keep a complete set of books, draw up statements at the end of the fiscal period, adjust accounts for accruals, deferred items, depreciation, and close the books.

6-352B. Principles of Accounting—Second Half

Spring, 3 credits. Repeated in Summer and Fall

PAUL S. CARTER
MAX HIRSCHHORN
RAYMOND A. LUCAS
DANIEL E. PALENSKI
HOMER McMILLAN
BERNARD H. ROSENBERG
WILLIAM V. SITKO
ANDREW TRONOLONE, JR.
SUSUMU UYEDA

Continuation of first half, covering more advanced principles of accounting. Accounting for partnerships, corporations, and manufacturing. Depreciation policies and analysis of financial statements. *Prerequisite*: Principles of Accounting (First Half), or equivalent.

6-353A. Intermediate Accounting—First Half

Fall, 3 credits

RAYMOND KURLANDER
W. FLETCHER LUTZ
HOMER McMILLAN

No actual keeping of system of accounts, but independent evaluation of existing accounts for conformance with sound valuation and accounting principles. Methods of correcting unsound account practices. Alternative methods of presentation on financial statements. Evaluation of asset and liability valuation and statement presentation principles in following areas: Cash, receivables, inventories, current liabilities, and investment accounts, including bonds, stocks, and special funds. Analysis of working capital in terms of content and significance on financial statements. *Prerequisite*: Principles of Accounting, or equivalent.

6-353B. Intermediate Accounting—Second Half

Spring, 3 credits

RAYMOND KURLANDER
W. FLETCHER LUTZ
HOMER McMILLAN

Continuation of valuation and statement presentation principles in following areas: (1) Plant and equipment. Its acquisition and retirement; depreciation and depletion; revaluations, (2) Intangibles. (3) Long-term liabilities. (4) Paid in capital—upon corporate formation and subsequent changes. (5) Retained earnings—free for dividend distribution and appropriated. Preparation of statements from incomplete records. Errors and their correction. Analysis of financial statements. Source and application of funds statements. Cash flow. Financial statements adjusted for price-level changes. *Prerequisite*: Intermediate Accounting (First Half), or equivalent.

6-420. Advanced Accounting—Theory and Problems

Year, 3 credits each semester

ARNOLD L. BARON

Advanced principles of accounting and their application to specific problems. Consolidated statements. Foreign exchange. Receivership. Estates and trusts. Public accounts. Emphasis on problems in accounting theory and practice as generally given in Certified Professional Accountant examinations. *Prerequisite*: Intermediate Accounting, or equivalent.

6-264. Federal Government Accounting

Year, 2 credits each semester

THOMAS C. CANADA

First semester: Study and application of basic principles and practices of accounting in Federal agencies. Concepts and methods of fund control systems. Practice with basic records-obligation control, cash disbursement, object class, general ledgers, and cost ledgers. Accounting for funding processes-appropriation, apportionment, allotment, obligation, disbursement, reimbursement. Transfer appropriation accounts-consolidated working fund advances. Elementary principles of accrual accounting. Second semester: Inventory and property accounting. Reimbursable operations financed by revolving funds. Advanced principles of accrual accounting. Reporting of accrued expenditures (Form BA-6727) and accrued revenues (Form BA 6728). Preparation of financial reports—SF-133, SF-224, SF-225, SF-220, 221, 222, BA-R 2108 (Sec. 1311 report). Accounting in decentralized operation. Accrued cost accounting for areas of program responsibility—relationship to cost-based budgeting—support for planning-programming-budgeting system. Year-end closing. Accounting for lapsed appropriations; transfers, restorations to successor "M" accounts. *Prerequisites*: Principles of Accounting, or equivalent.

6-276. Public Utility Procedures and Methods

Spring, 3 credits

GORDON F. HEIM

Public utility accounting, economies, rate making, rate of return procedures, with emphasis on legal concepts of public utility regulations.

6-601. Principles of Auditing

Fall, 3 credits

MAX W. ALGER

Principles and practices involved in audits, with emphasis on governmental auditing. Consideration of purposes and types of audits. Auditing concepts and standards. Planning and performing audits. Review of internal controls, preparation of work papers, and report writing. Utilization of audit principles in auditing operations of agencies in Federal Government. *Prerequisite*: Intermediate Accounting, or equivalent.

6-650. Audit and Investigation Management—Seminar

Year, 3 credits each semester

LEONARD H. GREES

Discussion of executive, mid-management, and line-management responsibilities in internal audit and investigation function under broad and dynamic management mandate. Starting with placement of function in total organization, discussion of pros and cons of alternate elements, basic policies, and procedures to govern operations. Development of position descriptions for personnel employed at management levels in this activity, providing the student with opportunity to consider qualifications and grades of personnel to be employed. *Prerequisites*: Experience in internal audit and investigation, or in administrative or management analysis at Grade GS-12, or above. Scheduled upon demand.

6-642. Cost Accounting

Year, 3 credits each semester

JAMES H. LOBB

Principles of cost accounting, together with methods of application to specific problems. Consideration of methods of cost accounting for materials, labor, direct and indirect expenses in relation to specific job orders. Process, departmental, and standard costs. Control accounts. *Prerequisite*: Principles of Accounting.

6-510. Analysis and Interpretation of Financial Statements

Fall, 2 credits. Repeated in Spring

STEPHEN J. VARHOLY

Methods and techniques of preparing, analyzing, and interpreting financial statements of business and Government enterprises. Nature and limitations of financial statements, and terminology, content, and organization, and determination and interpretation of trends and ratios for both internal and external users of financial statements. *Prerequisite*: Principles of Accounting.

6-645. Federal Income Taxes

Year, 3 credits each semester

HAROLD K. WILSON

First semester: Principles of Federal income taxation applied to individuals for determination of gross income, deductions, credits, and exemptions. Forms of various tax returns. Application of principles of accounting. Second semester: Principles of Federal income taxation applied to sole proprietorships, partnerships, and corporations. Survey of fiduciary returns. Federal estate and gift taxation. Taxation of foreign income. Special permission required to take second semester without first.

Social Sciences

DEPARTMENTAL COMMITTEE

Wesley B. Sundquist, *Chairman*

James A. Bayton, John M. Curtis, Joseph L. Fisher, Martin Kramer, S. Eugene Long,
Harry C. Trelogan (*Vice-chairman*), Bennett S. White, Jr.

The problems of social organization and operation have become both absolutely and relatively more important with the increase in the complexity of our industrial civilization. As a consequence, the Federal departments and agencies, as well as governments at state and local level, have need for personnel adequately trained in the social sciences. Moreover, the individual as consumer and investor, the businessman and the farmer as producer, also find need for knowledge of economics and the social sciences. Large corporations employ economists to help in the formulation of policy. Psychologists and social workers find demand for their services in personnel work.

To meet the needs of the Federal employee in particular and of other groups as is feasible, the Department of Social Sciences offers the following courses designed to aid the student in acquiring general background in the social sciences as well as specialized training in fields for which there is current demand.

Economics

COMMITTEE

Open, *Chairman*

James P. Cavin, Wendell E. Clement, Paul E. Nelson, Jr., Howard S. Piquet, Edward A. Robinson, Harry A. Steele, William A. Vogely

Adequate foundation training in general economics is essential for satisfactory accomplishment in the study of any specialized branch of the subject. Hence, the primary objective in developing the following courses has been that of providing the basic work needed by students who wish to carry out a systematic plan of study, at both undergraduate and graduate levels.

7-201. Principles of Economics

Year, 3 credits each semester

NEVILLE J. G. DOHERTY
GERALD L. DUSKIN
THOMAS F. HADY
STANLEY MILLER
HARVEY SHAPIRO

Designed to familiarize the student with basic tools of economic analysis and their application to questions of economic policy. First semester: Resources, production, and capital formation. Business organization and finance. Money and the banking system. Volume of economic activity and control of fluctuations. Second semester: Functioning of price system. Distribution of national income. International economics. Economic growth. It is strongly advised that the semesters be taken in sequence. However, under exceptional circumstances, the second semester may be taken without the first.

7-200. Economics for Consumer Use

Fall, 2 credits

PAUL E. NELSON, JR.

Money and credit management. Information sources and practices relevant to purchase of products and services. Grades. Standards. Consumer protection. Role of consumer in today's economy.

7-560. Modern Economic Thought

Spring, 3 credits

JAMES P. CAVIN and ALLEN B. PAUL

Designed to help the student trace roots of modern economic thought to such representative economists of past 50 years as: Alfred Marshall, Edward Chamberlain, Wesley C. Mitchell, John M. Keynes, John M. Clark, Joseph Schumpeter, John R. Commons, Thorstein Veblen, Joan Robinson, and Milton Friedman. *Prerequisite*: Principles of Economics, or equivalent.

7-548. Intermediate Economic Analysis

Year, 3 credits each semester

CLARK EDWARDS

Use of basic tools of economic analysis. Understanding intermediate economic theory and methods used to solve economic problems. First semester: Macro-economics. Analysis of general determinants in American economy of income, employment, production, price level, growth, and cyclical change. Second semester: Micro-economics. Analysis of individual consumer demand, market structure, and theory of firm. Inquiry into general determinants of relative prices and income distribution. Review of elementary principles. The student may attend either or both semesters. *Prerequisites*: Principles of Economics and some acquaintance with elementary algebra.

3-509. Mathematics for Economists

(See P. 44)

7-570. Introductory Econometrics

Fall, 3 credits

RICHARD J. CROM

Statistical and mathematical concepts used in measuring economic relationships. Emphasis on formulation, estimation, and interpretation of single-equation relationships. Estimation of simultaneous economic relationships. *Prerequisites*: Intermediate Economic Analysis, intermediate mathematics, and one course in statistics, or equivalent.

7-477. Regional Economics

Fall, 3 credits

GERALD L. DUSKIN

Basic concepts, objectives, and goals of regional economic development. Emphasis on basic principles, tools of analysis, and current planning issues. Historical development and early contributions to regional economic theory. Economic base theory and multipliers. Growth center and central place theory. Industrial location analysis. Sector and sub-sector development analysis. Problems of urbanization-industrialization in rural areas. Input-output analysis. Regional income estimation and social accounting. Appraisal of current regional development programs. New town planning. European regional development experience (France, Great Britain, Spain). *Prerequisite*: Intermediate Economic Analysis, or equivalent.

7-564. Regional and District Development Planning

Fall, 3 credits

ALAN R. BIRD

Multi-state and multi-county development planning as evolving processes related to national and subnational policies and programs. National economic, technological, locational, demographic, and other social conditions and constraints. Historical, present, and projected planning activities. Role of planning staffs and related staff functions. Exploration of ways of improving the planning process and identifying and updating the most strategic components of a plan. Evaluation of plans. Designed as vehicle for systematic exchange and consolidation of experience among Federal, state and local staffs and other citizens involved or expecting to be involved in regional, state or multi-county development, manpower or resource planning. Formal training in social sciences helpful, but not required.

7-489. Resource Economics (1970-71 and alternate years)

Fall, 3 credits

WILLIAM B. BACK and GENE L. WUNDERLICH

Theories of income distribution emphasizing natural and human resources. Concepts of property. Relations among property institutions, public programs, and income distribution. Incidence of benefits and costs of selected public programs. Issues in land settlement and location of economic activity. *Prerequisite:* Course in intermediate economics, or special permission.

7-476. Public Finance and Fiscal Policy

Fall, 3 credits. Repeated in Spring

PETER WAGNER

Economics of government finance, taxing, borrowing, and spending by Federal, State, and local governments. Emphasis on basic principles and tools of analysis, with current policy issues for illustration. Economics of government spending, allocation of resources between public and private sectors, borrowing and the public debt, fiscal policy, and taxation. General principles of taxation, incidence, and the like. Problems of specific types of taxes. *Prerequisite:* Principles of Economics, or equivalent.

7-480. Money and Banking

Spring, 3 credits

HARVEY SHAPIRO

Designed to help the student understand functions of money and credit in modern economy. Functions of money. Commercial bank operations and creation of credit. Monetary theory. Principles and practices of central banking and credit control. Role of money in relation to employment, prices, and business cycles. International monetary relations. *Prerequisite:* Principles of Economics, or equivalent.

7-497. Urban Economics

Fall, 2 credits

JOHN J. HURLEY
CHARLES E. MUELLER

Urban complex as special kind of environment within which principles of economics can be applied. Examination of major problem areas of urban economics in systematic way. Poverty and income distribution. Imperfections in local labor market. Advertising deceptions and consumer protection. Municipal taxation and budgets. Land use and urban sprawl. Urban renewal. Rent supplement issues. Public housing programs.

7-491. Industrial Organization and Public Policy

Spring, 2 credits

PAUL E. NELSON

Review of classical imperfect competition theory and extensions into joint profit maximization, nonprice competition, and bilateral monopoly. Theoretical and policy considerations: Market structure analysis, barriers to entry, and workable competition. Evaluation of government policy with respect to concentration, mergers, and oligopoly conduct. Appraisal of current structural trends and policy alternatives. *Prerequisite:* Principles of Economics, or equivalent.

7-576. Urban Centers, New Towns, and Rural Development

Fall, 3 credits

ROBERT BLUM and BETTY L. DOOLEY

Designed to develop overall perspective for analysis of human, social, and economic problems in relation to man's environment. Use made of systems approach and cost/benefit analysis in relation to problems, policies, programs, and action. Seminar for coordinated consideration of fields of interest to students.

7-526. Introduction to International Economics

Spring, 3 credits

CAREY B. SINGLETON, JR.

Basic concepts and analytical tools and their application to international economics. Introduction to theory and empirical foundations of international trade and factor movements. Theory of multi-

country, multicommodity trade. Problem of international disequilibrium. Public and private barriers to trade and monopoly of international trade. Search for economic stability and growth through international cooperation. International Monetary Fund. International monetary system. Problem of underdeveloped areas—meaning and extent of economic underdevelopment. Role of international trade and aid in economic development. Future of international economic relations. *Prerequisite*: Principles of Economics, or equivalent.

7-468. Economics of Transportation

Fall, 3 credits

JOHN O. GERALD and BRUCE H. WRIGHT

Survey of trends in economic development of nation's rail, highway, water, pipeline, and air transportation systems. Regulatory controls and problems arising from bulk water and highway exemptions. Ratemaking with near technological monopoly by railroads, to 1920's. Growth of intermodal competition, 1920's to present. Effects of recent ratemaking and ownership trends on location of industry and on interregional competition, with principal illustrations from agriculture. *Prerequisites*: Principles of Economics and course in statistics, agricultural economics, marketing, or transportation.

8-474. Engineering Economics (See P. 111)

8-712. Engineering Economic Analysis (See P. 111)

7-780. Theories of Economic Growth

Spring, 3 credits

JOSEPH W. WILLETT

Systematic study of economic growth problems and principles. Definitions and elements of economic growth, with emphasis upon natural resources, population, capital, technology, markets, and institutions. Economic growth models under varying stages of development and varying market and institutional limitations. Foreign and domestic applications.

6-440. Metropolis: Government, Finances, and People
(See P. 76)

7-336. Agriculture's Role in Economic Growth and Development

Fall, 3 credits

QUENTIN M. WEST and JOSEPH W. WILLETT

Economic analysis of contribution that agricultural sector has made to economic development in developed countries and its potential contribution to growth in less developed countries. Key role of agriculture in relation to world food problem. Factors affecting supply of and demand for food and fiber. Agriculture's role as user and supplier of labor, capital, and foreign exchange. Analysis of agricultural policies and planning for agricultural development. Evaluation of role of foreign trade and aid in agricultural development. *Prerequisite*: Intermediate Economic Analysis, or special permission.

[7-716.] Agricultural Policies and Programs—Seminar (1971-72 and alternate years)

Spring, 2 credits

M. L. UPCHURCH

Analysis and evaluation of current agricultural policies and programs with special reference to planning and programming techniques and processes, including review of policy and program development from First World War to date. Consideration of agricultural policies and programs in relation to economic principles as well as chief trends or forces operating within national economy as a whole. Effort to consider all the main streams of agricultural policy, including problems relating to research, education, and marketing, as well as farm price supports. *Prerequisite*: Bachelor's degree in agriculture or related field, with some courses in economics, or operational responsibility in agricultural programs.

7-239. Natural Resources and International Economic Development

Fall, 3 credits

CAREY B. SINGLETON, JR.

Designed to portray and interpret relationship between natural resource endowment and economic growth in broad regions of world—Western Europe, Soviet Union, Africa, and Latin America. Interdependence between resources and techniques, policies, and institutions that control resource capability. Contributions that effective resource management and entrepreneurship can make to the economic growth of developing nations. Potentialities and constraints of foreign investment for resource development, terms of trade between raw material exporting and importing countries, and transfer of knowledge and capital across national boundaries. Problems of economic infrastructure. Importance of linkage concept in resource endowment and economic development. Agricultural transformation and industrialization for developing countries.

7-572. International Monetary Policy

Fall, 3 credits

WILLIAM B. KELLY, JR.

Balance of payments with particular reference to United States. Problem of international liquidity and recent developments and proposals—reevaluation of gold, Special Drawing Rights (SDR's), international reserve settlement account, supra-national bank. International adjustment mechanism and proposals for its reform—gold standard, adjustable peg, crawling peg, band proposal, flexible exchange rates. International Monetary Fund (IMF). Foreign investment and its effects on resource allocation, employment and international trade and payments. Multinational corporation. *Prerequisite*: Principles of Economics. This course is integrated with International Trade and Commercial Policy, but may be taken separately.

7-528. International Trade and Commercial Policy

Spring, 3 credits

WILLIAM B. KELLY, JR.

Classical and modern theories of international trade. Tariffs (including effective tariff rates) and nontariff barriers. Subsidies and dumping. Most-favored-nation (MFN) policies and tariff preferences for less-developed countries. International commodity agreements. Customs union theory and regional trade arrangements, particularly the European Economic Community (EEC), European Free Trade Association (EFTA), and proposals for North Atlantic Free Trade Area (NAFTA). General Agreement on Tariffs and Trade (GATT) and United States trade policy. *Prerequisite*: Principles of Economics. This course is integrated with International Monetary Policy, but may be taken separately.

7-532. International Marketing and National Export Expansion

Year, 3 credits each semester

ALTON B. ASHENDORF
WILLIAM H. TROTTER

Designed for business, trade association, and government personnel engaged in international and/or commercial affairs. Survey of fundamentals and current practices in international business, marketing, and investments. Federal and private activities and services related to National Export Expansion Program. International market promotion and development by United States and other nations in mature and developing markets. Public and private international marketing. Domestic and overseas marketing factors of research, selling, manufacturing, legal, technical, and financial for industry, consumer, and agricultural goods and services. Guest lecturers by international trade executives exploring trends and problems in foreign commerce.

7-503. African Society and Economics of African Development

Spring, 3 credits

CAREY B. SINGLETON, JR.

Economic position and potential for self-sustained growth of African nations. Legacy of colonial era. Mores and traditions affecting African standard of living. Geographical obstacles. Structure of African national economics. Taxes. Trade position. Effects of private investment and foreign aid. Unique infrastructure needs in transport, electric power, communications, and education.

7-469. Economics of Cooperative Enterprise

Fall, 3 credits

MARTIN A. ABRAHAMSEN

Analyses of cooperative principles and practices. Appraisal of economic forces leading to cooperative development. Evaluation of role of cooperatives in economy. Types of cooperatives and special legal, organizational, managerial, membership, and financial problems relating to cooperative performance.

7-260. Economic Geography

Spring, 3 credits

WILLIAM H. TROTTER

Economic factors, historical current, and potential of countries of world. Auxiliary factors of population explosion, political doctrines, investment climate, new materials and changing economic conditions. Inter- and intra-area dependency, common market formations, and eco-political foundation. Specialists from foreign embassies to discuss economic condition and geophysical and eco-environment of their countries.

7-504. Public Policy and Environmental Pollution—Seminar

Fall, 2 credits

THOMAS C. JORLING
DONALD E. NICOLL

Examination of impact of air, water, and soil pollution on man and his society. Implications of environmental pollution problems for government programs and activities. History of pollution control efforts and influence of economic, technological, and institutional factors on various public policy approaches to pollution control and abatement. Readings, papers, resource people, and discussion.

7-2. How and Why of Stock Investments I

Fall, non-credit

BERNARD WEXLER

Designed to teach the investor fundamental principles of investing in modern securities markets. All aspects of stock market operations. Investment decision-making. Correlation of broader aspects of operations of brokerage firms and members of New York Stock Exchange with what the investor should know about internal operations of stock market. Use of films to supplement lectures.

7-3. How and Why of Stock Investments II

Spring, non-credit

BERNARD WEXLER

Tools of analysis for individual investor and their application, including preparation of specific analyses. *Prerequisite:* How and Why of Stock Investments I, or general knowledge of securities and trading.

Human Relations**COMMITTEE**S. Eugene Long, *Chairman*

Lee K. Buchanan, Norman S. Gould, James O. Howard, Arthur E. Newman,
Conrad F. Taeuber

The following courses in human relations and related areas are designed to meet a number of needs on varying levels. Some are for those who want to add to their general knowledge of social problems and processes. There are also courses for the student at the elementary undergraduate level, as well as at the specialized undergraduate and graduate level. Finally, for the mature person, there are courses that try to use the knowledge of all the social sciences in considering public issues and policy.

7-210. General Psychology

Fall, 3 credits. Repeated in Spring and Summer

HENRY J. DE HAAN
NORMAN S. GOULD

First course in psychology. General processes and principles of behavior and facts on which they are based. Methods of studying psychological data. Emphasis on motivation, emotion, frustration, conflict, learning, thinking, sensing, perceiving, and personality development and measurement.

7-222. Psychology of Adjustment

Fall, 3 credits. Repeated in Spring

ROGER O. BRADY

Second course for beginning student in psychology. Concerned with dynamics of life adjustment, mental hygiene, and effective measures for combatting mental illness. Consideration of problems of psychopathology and modes of treatment. *Prerequisite:* General Psychology, or equivalent.

7-235. Introductory Social Psychology

Fall, 3 credits. Repeated in Spring

IRVING FOOTE

Review of basic psychological concepts of cognition and motivation and their use in understanding social behavior. Examination of certain aspects of social psychology including attitude, attitude change, nature and modification of prejudice, and group processes. *Prerequisite:* General Psychology, or equivalent.

7-446. Personnel Psychology

Fall, 3 credits. Repeated in Spring and Summer

ROGER O. BRADY

Practical applications of psychological and sociological findings to management of people at work. Vocational adjustment, motivation and job satisfaction, attitudes and morale, supervision and leadership, social class factors, and interpersonal communication. Psychological tests of ability, personality, vocational interests, and job achievement. Personnel selection, training, employment, interviewing, measurement of job performance, and organizational structure. Accidents and safety. The student takes certain psychological tests used in field of personnel psychology. Prior courses in general psychology or personnel administration helpful, but not required.

7-462. Educational Psychology

Summer, 2 credits

RUTH E. MYER

Current methodology in educational psychology. Creativity, emotional factors, interests, intelligence, and motivation as well as other factors operating in learning performance. Theories of learning including transfer of training, memory, discrimination learning, problem solving, thinking processes, association theory, operant conditioning, verbal behavior, and psycho-linguistics examined. Consideration of group and individual differences in learning and performance. Characteristics of effective teachers. Special problems of the exceptional child, and remedial learning. *Prerequisites:* Prior courses in general psychology helpful, but not required.

7-322. Cross-Cultural Psychology

Fall, 3 credits

RICHARD W. BRISLIN

Comparative behavioral data gathered in two or more cultures. General and social psychological concepts studied cross-culturally. Methodology. Training for effective different culture interaction. Organizational requirements in different countries. Use of anthropological data files.

7-304. Conditions of Personality Growth

Fall, 2 credits

EUGENE STAMMEYER

Principal factors influencing personality development. Physiological bases, early experiences, and cultural determinants. Experimental and clinical contributions to study of personality and their application to practical problems of understanding and dealing with people.

7-442. Personality Integration and Problems in Living

Spring, 3 credits

ALBERT C. CORNSWEET

Aspects of personality that contribute to emotional integration of the person. Global and dynamic nature of personality development. Social, economic, culture, environmental, and experimental factors in living. Contributions of variations in these factors to fluctuations in behavioral patterns and difficulties in problems of adjustment and living. Schools of thought contributing to theories of personality. Exploration of these theories as alternate means of dealing with special problems in daily living. Designed to bring about mature comprehension of behavioral variations with recognition and methods of appropriately dealing with them.

7-541. Improving Human Relations and Group Behavior

Fall, 2 credits. Repeated in Spring

CARL F. BAUER

Emphasis on importance of recovering personal identity and responsibility in our mass civilization. Organic experience of organized materials of the course through practice in methods, techniques, and skills of "Group Dynamics." Team method of training leaders, face-to-face analysis, free association, non-directive and developmental discussion, problem census, group decision method, informality, and interviewing.

7-573. Psychology of Dreams

Fall, 3 credits. Repeated in Spring and Summer

FRED D. RISSE

Readings from both Freud and Jung on psychology of dreams. Material on recent research in psycho-physiology of dreams and sleep. Materials relating to general psychological theories of Freud and Jung in order to provide perspective in which dream theory may be approached.

6-453. Human Relations in Administration (See P. 76)**7-600. Readings in Human Relations**

Fall, 3 credits. Repeated in Spring

MOZELLE B. KRAUS

Supervised readings with monthly conferences on topics in area of interest to the student, or individual research and paper on problem in human relations. Readings, or problem to be investigated, determined in consultation with an advisor. *Prerequisite:* Bachelor's degree, or special permission.

7-303. Child and Adolescent Psychology

Spring, 2 credits

EUGENE STAMMEYER

Development of human behavior from prenatal period through adolescence in terms of processes of physical, mental, emotional, and social growth in the individual. Emphasis on interactions of total personality of child.

7-323. Handicapped and Gifted Children with Special Educational Needs—Survey

Fall, 2 credits

SUDHANSU B. MITRA

History and philosophy of education of children with physical, psychological, or sociological problems, and of those with superior intellect, requiring special educational services. Different categories of such children. Their characteristics and needs based on social and psychological considerations. Plans and programs of services. *Prerequisite:* College level course in psychology or education, or special permission.

7-710. Abnormal Psychology

Spring, 3 credits

CHRIST W. KYRIAZIS

Behavior pathology as background for teachers, supervisors, and others dealing with people in effort to assist in early recognition of emotional disorders and to improve adjustment of individual

in group setting. History and approaches to study of abnormal behavior. Personality development. Causative factors. Diagnostic categories of abnormal behavior. Treatment and prevention of mental illness. *Prerequisite*: General Psychology.

7-400. General Semantics

Fall, 2 credits

FRANK R. ELDRIDGE

How we detect meaning, evaluate it, and communicate it to others. How we may become more perceptive as observers, more effective as evaluators, and more explicit as communicators. Devices for realizing how we react to language, how we evaluate it, and how we use it to communicate. Mechanisms that cause confusion of meaning. Clarification by understanding of useful devices and theories applied as tools of analysis, evaluation, and communication.

7-466. General Semantics—Seminar

Spring, 2 credits

FRANK R. ELDRIDGE

Discussion of works of Korzybski. Application of his theories and analyses of written material using general semantic techniques. *Prerequisite*: General Semantics, or equivalent.

7-545. Counseling Techniques

Fall, 3 credits

ALBERT C. CORNSWEET

Survey of theoretical and practical aspects of techniques used in guidance and counseling. Consideration of various schools of thought as related to behavior modification. Emphasis in areas helpful to individuals in fields of counseling, teaching, personnel work, and industrial management. Problem areas and recurring situations in interpersonal relations. Current and basic techniques utilized in direct and indirect counseling methods. Modes of verbal communications. Value of interview material. Assistance to and development of skills to meet exigencies of human factor in teaching, personnel operation, counseling, and industry. Case histories. Individual contributions by students. Also designed to assist individuals to recognize and deal with problem areas in human behavior. Understanding of dynamics of human behavior pertinent in development of these counseling techniques.

7-547. Counseling and Behavior Modifications—Seminar

Fall, 3 credits

ALBERT C. CORNSWEET

Designed for those dealing with personnel on counseling basis where situations and problems are in constant review. Individual presentations with exploration of psychological processes and dynamics involved. Specialized discussions around significant problem areas of case material. Intensive examination of contributing factors necessitating appropriate counseling technique or techniques. Survey of literature in areas of behavioral and psychological modifications. *Prerequisite*: Personality Integration and Problems in Living, or experience in field, or special permission.

7-536. Psychological Tests and Measurements

Fall, 3 credits

HAROLD J. DUPUY

Administration and interpretation of tests useful in assessing the individual's performance in areas of intelligence, aptitudes, interests, personality, and attitudes. Emphasis on interpretation of scores to client. Demonstration of individual intelligence tests including Binet and Weschler. Background material to assist in understanding construction of the test, such as norms used, reliability, validity, standard scores, percentiles, coefficient of correlations, and other statistical techniques. Individual projects. *Prerequisite*: Statistics helpful, but not required.

7-741. Changing Human Behavior—Seminar

Fall, 2 credits. Repeated in Spring

JOSEPH J. MCPHERSON

Basic principles involved in applying what is known about ways of changing human behavior, ranging from consideration of methods of simple persuasion to use of extreme techniques of influencing thinking and behavior sometimes referred to as "brain washing." Ethical questions involved in the use of such techniques. Designed for those concerned with planning programs intended to bring about

behavior changes. *Prerequisite*: Bachelor's degree or higher in education, psychology, sociology, or other aspects of social-psychological sciences, or special permission.

7-494. Research Methodology in Behavioral Sciences

Fall, 3 credits

STUART WRIGHT

Designed for those whose work demands command of methodology and criteria of sound research and thinking lying behind it. Concerned with design and evaluation rather than statistics. Assumption made that the student has familiarity with statistical methods. Review as needed of such techniques as analysis of variance, factor analysis, and non-parametric analysis. Designs written by the student for comment and development. Course shaped to needs of members. *Prerequisites*: Undergraduate degree and one or more courses in statistics, or special permission.

7-538. World Population Trends and Problems

Spring, 3 credits

SAMUEL BAUM

Population trends and prospects in United States as compared with other areas of the world. Malthusian and subsequent theories of population growth. History of growth and distribution of world's population. Trends in fertility, mortality, and migration, and their analysis in relation to social, biological, psychological, and especially, economic factors. Relation of population growth to economic development and resources. Concept of optimum population. Aesthetic considerations in population growth. Development of national population policies. Population prospects in United States and other countries. Implications for international relations. *Prerequisites*: Training in social sciences and statistics.

7-749. Urbanization and Mental Health

Fall, 3 credits. Repeated in Spring

MAURY LIEBERMAN and ASSOCIATES

Consideration of mental health in urban society. Meaning of mental health in urban America. Civil disorder, its causes and aftermath. Urban cultural analysis. Role of professional in urban ghetto. New forms of health and welfare services for metropolitan areas. Role of youth groups in minority community. Role of urban research during urban crisis. *Prerequisite*: Bachelor's degree in social sciences preferred.

7-549. Juvenile Delinquency

Fall, 3 credits. Repeated in summer

SAMUEL A. KRAMER

Extent, nature, variation, and causes of juvenile delinquency. Individual and social liability. Biological, social, and psychological factors. Operational and theoretical effectiveness of programs and proposals for prevention, control, and abatement. Juvenile courts, clinics, probation, parole, child placement, recreation, and education. *Prerequisite*: College level course in psychology, or sociology, or special permission.

7-120. Successful Retirement

Fall, 2 credits. Repeated in Spring and Summer

THELMA A. DREIS, HELEN S. PRYOR,
and GEORGE WOLFE

Designed to make retirement years more meaningful. Importance of preparing for retirement. Gains and losses in retirement. Transition from structured to unstructured life. Place of work in life cycle. Financial planning. Living arrangements in retirement. Travel. Courses. Volunteer work. Other major undertakings. Couples encouraged to register. (Offered in cooperation with Washington School of Psychiatry.)

7-552. Racial Conflict in United States—Seminar

Fall, 3 credits. Repeated in Spring

STUART WRIGHT

Structure and dynamics of modern racial-culture interaction problems, using interdisciplinary approach. Relevant material from anthropology, psychology, physiology, and sociology introduced against historical time-line to analyze present developments and to develop perspective for understanding of future changes. Emphasis primarily on problems of American Negro-white conflict. *Prerequisites*: College courses in anthropology, or psychology, or sociology.

7-554. Crime Problem

Spring, 3 credits

SAMUEL A. KRAMER

How behavior becomes criminal. Categorical risks. Basic issues in causation. Crime as business, including professional, organized, and white collar. Affiliated problems of juvenile delinquency, addiction, gambling, and prostitution. Trends in punishment, imprisonment, and substitutes. Probation and parole. Crime control and prevention. *Prerequisite:* College level course in psychology, or sociology, or special permission.

6-355. Administration of Poverty and Hunger Programs

(See P. 76)

7-125. Drug Abuse

Fall, 2 credits. Repeated in Spring

WILLIAM C. MCKINNEY

Directed to urgent need for examination of realistic, meaningful, and obtainable objectives and goals relating to drug abuse. Response to alarming increase of drug use, misuse, and abuse by youth in inner-city as well as suburbia. Social and economic ramifications associated with this rise. Examination of current programs and projects designed and implemented in exclusion of basic in-depth knowledge and understanding of problem and individuals affected by or involved with drugs and narcotics. Effort to develop models to utilize all community resources in combatting this problem.

7-115. Introduction to Sociology

Year, 3 credits each semester

SIDNEY WEINSTEIN

First semester: Cultural backgrounds of social life, personality, and social structure. Forms of collective behavior. Impact of groups and institutions on social behavior of man. Second semester: Sociological analysis of major problems in contemporary society. Social interaction, disorganization, change, and control. Analysis and application of social theory. Qualified students may be admitted without having taken the first semester.

7-640. Medical Sociology I

Fall, 3 credits

SAMUEL A. KRAMER

Impact of disease on concepts and structures of social groups. Health and illness affecting and affected by United States cultural patterns. Socio-economic conditions. Folkways. Other factors involved in recognition, availability, and acceptance of medical services through private practice, hospital, clinic, and public health activities. Social stratification and prevailing medical practices. Changing status of medical profession.

7-642. Medical Sociology II

Spring, 3 credits

SAMUEL A. KRAMER

Social and cultural implications of disease, including psychiatric considerations. Medical and religious aspects of health. Medical education as social process. Methods of research in medical sociology, including class or individual research projects. *Prerequisite:* Medical Sociology I, or special permission.

7-706. Sociological Literature—Seminar

Fall, 3 credits

DENIS F. JOHNSTON

Seminar based on readings from works of earlier and contemporary sociologists, including Durkheim, Mannheim, Merton, Parsons, Sorokin, and Weber. Relation between theory and research stressed. Designed for advanced students wishing to broaden familiarity with major contributions and underlying concepts of modern sociology. *Prerequisites:* Bachelor's degree and courses in sociology, or advanced study in closely related discipline.

7-265. Everyday Logic and Powers of Mind

Fall, 3 credits. Repeated in Spring

JAMES M. KEYS

Practical application of rules of right reasoning to everyday situations: Newspaper editorials, magazine advertisements, staff meetings, committee reports, discussions with boss, colleague, or spouse. How to discover and maximize power of mind.

7-314. Contemporary Situation in Philosophy

Fall, 3 credits

BOB HOKE

Study of basic problems of man as presented in three major courants of contemporary philosophy: Existentialism (atheistic and religious), phenomenology, and analytic philosophy.

7-302. General Anthropology

Fall, 3 credits. Repeated in Spring

DONALD J. ORTNER

Survey of primate evolution and development of man, both biologically and culturally, from Stone Age to contemporary times. Emphasis on method and theory of anthropology and practical extension of theory in analysis of effects of total environment on individual.

6-250. American History to 1865 (See P. 77)

6-251. American History Since 1865 (See P. 77)

6-255. West in American History (See P. 77)

International Relations

The courses listed below are useful for those concerned with the international position of the United States.

7-526. Introduction to International Economics (See P. 96)

7-239. Natural Resources and International Economic Development (See P. 98)

7-572. International Monetary Policy (See P. 98)

7-528. International Trade and Commercial Policy (See P. 98)

7-503. African Society and Economics of African Development (See P. 98)

7-542. Russia: Yesterday, Today, and Tomorrow

Fall, 3 credits. Repeated in Spring

ANTHONY F. CZAJKOWSKI

Survey of political, economic, social, and ideological forces in history of Russia, influencing current policies. Half century of Communist rule, with emphasis on Lenin's establishment of Com-

munist state, Stalin's attempts at industrialization with attendant internal dislocations. Second World War and postwar expansion. Changes in leadership and policies since death of Stalin in 1963. Required and suggested readings. Class discussion on selected topics.

7-499. Introduction to Modern China

Fall, 3 credits. Repeated in Spring

MARCIA R. RISTAINO

Designed to familiarize the student with the historical and cultural background against which China emerged from long self-imposed isolation as modern state in international community, culminating in overthrow of Manchu dynasty and founding of Republic in 1911. Analytical as well as descriptive in presentation. Required and suggested readings.

7-531. Subsaharan Africa: Introduction to Peoples and Cultures

Fall, 3 credits. Repeated in Spring

PATRICK H. MECHEM

Survey of precolonial history. Races and languages. Demography and population movements. Comparative colonial policies. Traditional social, economic political, and religious systems in transition.

7-563. Latin American History

Fall, 3 credits

GILBERT P. RICHARDSON

Pre-Conquistadorian settlements. Discoveries. European conquests. Expansionist, independence movements in Caribbean, Central, and South American areas. Socio-political revolutionary movements. Analysis of insurgents organizing revolts. United States and Latin American relations through Second World War. Organization of American States.

7-557. Latin American Developments and Potentials

Spring, 3 credits

GILBERT P. RICHARDSON

Regional appraisal of Latin America in Western Hemisphere to analyze current social, economic, and political conditions. Legacy of exploitation traced from earlier days through current socio-political clashes arising from land reforms and improved transportation and communication. Political relations with United States. Various pressure points in international relations.

7-567. American Diplomatic History to 1900

Fall, 3 credits

JOSEPH G. WHELAN

General survey and analysis of American diplomatic history from 1775 to 1900. Review of factors influencing American attitudes in foreign affairs and formation of foreign policy. Examination of United States foreign affairs relating to war and continental expansion. Problems posed by European powers. Assertion of hemispheric leadership. Emergence as Pacific and Far Eastern power.

7-568. American Diplomatic History since 1900

Spring, 3 credits

JOSEPH G. WHELAN

General survey and analysis of American diplomatic history since 1900. Ascendancy of United States as world power. Development of American Pacific and Far Eastern interests. Diplomacy of First World War and aftermath. Isolationism in 1920's and 1930's. Second World War and emergence of American global diplomatic interests. Stress on period since 1945 and Cold War. Designed to create better understanding of United States role in contemporary world affairs.

7-20. World Politics—Study Discussion Group

Fall, non-credit. Repeated in Spring and Summer

STUART H. SWEENEY

Understanding issues and events in international arena. What causes war? State and individual. Democracy. Communism. Domination. Self-determination. Power politics and ideology. International organization and world government. Means and ends in world politics.

Technology

DEPARTMENTAL COMMITTEE

Francis A. Gregory, *Chairman*

Evan L. Flory, Milton A. Ford, Garnet W. Jex, Donald R. McClelland,
Henry A. Sawchuk, G. C. Tewinkel

Many departments and agencies of the Federal Government are engaged in programs involving in varying degrees engineering techniques and professional engineers. Among these programs are housing, rural electrification, electric power development and transmission, the application of electronics to industry and transportation, soil conservation, highway planning and construction, and mapping and photogrammetry. Workers in these areas must master numerous functions that require intimate and systematic working knowledge not provided in the standard college engineering and related technical course of study.

Basically, education in engineering schools is limited by necessity and tradition to a period of four or five years. This relatively short training period is sufficient for the mastery of only a minimum of the basic sciences. There is little time for courses that give the technical student an understanding of the social and economic problems of the world around him. As a result, he often fails to appreciate the impact upon society of the advances of his profession. Technological techniques and practices are moving forward at an ever increasing rate. New developments in the sciences and engineering require the enlargement and constant reorientation of the technical background of the engineer.

The Graduate School, with the aid of representatives of Government departments and agencies and of the local chapters of engineering societies, offers courses especially adapted to the technical, professional, and administrative background of engineers in the Federal Government. Because of the competence and experience of the instructors in their respective fields, many of the courses give training in current techniques that the colleges and technical institutes cannot provide. These help the student to broaden his background, to increase his efficiency, and to develop his professional capacity.

Engineering

COMMITTEE

Henry A. Sawchuk, *Chairman*

James V. Bernardo, Leon H. Blumenthal, William J. Bobisch, Philip L. Brach, Walter M. Carleton, Ferdinand Kaufholz, S. D. Keim, John H. Rixse, Jr., Hyman A. Schwartz

CERTIFIED STATEMENT OF ACCOMPLISHMENT IN GENERAL ENGINEERING

A Certified Statement of Accomplishment in General Engineering is granted to a student who has completed an organized course of study intended to provide basic training approximately equivalent to the first two years of engineering school. Graduation from high school, or the equivalent, is the minimal educational background required. An applicant for the certified statement must file a transcript of his high school or college record before completion of the program.

Required courses: (73 semester hours)

1. Mathematics and Statistics
College Algebra (3)
Trigonometry and Analytic Geometry (3)
Calculus (Differential and Integral) (6)
Principles of Statistical Analysis (3)
2. Languages
English Composition (3) or
Technical Writing (2)
Public Speaking for Beginners (2) or
Advanced Public Speaking (2)
3. Physical Sciences
General Chemistry (6)
Principles of Physics (4)
Modern Physics (2)
4. Public and Business Administration
American National Government (3) or
Basic Accounting—Concepts of Terminology (2)
Introduction to Public Administration (2) or
Legislative Process (2)
Principles and Practices of Management (2)
5. Engineering
Analytical Mechanics (Statics and Dynamics) (3)
Engineering Applications of Digital Computers (3)
Engineering Economics (3)
Engineering Mathematics (4)
Engineering Reliability (2)
Fundamentals of Digital Computer Design (3)
Principles of Electricity (including electronics) (4)
Principles of Specifications (2)
6. Subject-Matter Electives: (12 credits)

These remaining credits may be selected from more specialized engineering courses or other approved courses.

A student seeking this certified statement should consult with the Registrar and obtain approval of his proposed course of study early in his academic program. Equivalent courses will be accepted by transfer from other institutions.

8-92. Review of Engineering Fundamentals for P. E. Examination

Fall, non-credit. Repeated in Spring

JOHN H. RIXSE, JR.

Refresher course in basic sciences and engineering principles intended to assist in preparation for basic portions of District of Columbia Professional Engineer's License Examination (not specific branches of engineering). Covers elements of strength of materials, structures, fluid mechanics, mechanical engineering, electrical engineering and engineering economics. *Prerequisite:* Preferred, those qualified to take the examination. Must be taken for credit.

8-93. Civil Engineering Review for P. E. Examination

Fall, non-credit. Repeated in Spring

JOHN D. O'FALLON

Refresher course for candidate preparing for Professional Engineer's License Examination in field of civil engineering. Covers solution of practical problems in foundations, highways, hydraulics, and steel and concrete structures. *Prerequisite:* Preferred, those qualified to take the examination.

8-95. Electrical Engineering Review for P. E. Examination

Fall, non-credit. Repeated in Spring J. J. A. JESSEL, CLEVE R. JACOBSEN, and NORMAN JOFFE

Refresher course for the student preparing for the D. C. Professional Engineer's License Examination in field of electrical engineering with emphasis on power. Solutions of practical problems. *Prerequisite*: Preferred, those qualified to take the examination.

8-98. Mechanical Engineering Review for P. E. Examination

Fall, non-credit BRIAN R. JESSOP

Refresher course for candidates preparing for Professional Engineer's License Examination in field of mechanical engineering. Emphasis on solution of advanced problems in fields of air conditioning, economics, engineering, hydraulics, mechanics, power applications, and structures. *Prerequisite*: Preferred, those qualified to take the examination.

8-110. Principles of Electricity

Year, 2 credits each semester DAVID ASKEGAARD

Basic principles of direct- and alternating-current generation. Distribution and utilization in lighting, power and communications, including introduction to electronics. Topics in mathematics needed in course, including use of slide rule (required), elementary trigonometry, logarithms, and some algebra including simultaneous equations.

8-443. Analytical Mechanics I: Statics and Dynamics

Fall, 3 credits JOHN G. VINER

Rigid bodies in equilibrium under action of forces and couples. Principles of kinematics and kinetics of particles and rigid bodies. Plane motion, work and energy, and impulse-momentum relations. *Prerequisite*: Differential calculus, or special permission.

8-444. Analytical Mechanics II: Strength of Materials

Spring, 3 credits JOHN G. VINER

Stress and strain in beams, columns, and torsional members. Continuous beams. Problems in combined stress. Inelastic behavior. Special topics as time permits. *Prerequisites*: Analytical Mechanics I and differential calculus, or special permission.

8-465. Fundamentals of Electronics

Year, 3 credits each semester JOHN J. CULLINANE

Analytical presentation of principles of electronics. First semester: Electron flow in solids, emission, diodes, P-N junctions. Fundamental principles of transistors and vacuum tubes. Circuit analysis involving linear, passive components. Characteristics of resonant circuits, transformers, transmission lines, antennas. Voltage amplification, untuned and tuned amplifiers. Second semester: Feedback in amplifiers, Class A, B, and C power amplifiers. Rectifiers and power supplies. Sine wave oscillators. Amplitude modulation and detection. Frequency modulation. Transmitters. Receivers including superheterodyne. Basic pulse circuits. *Prerequisites*: Mathematics for applied electricity and Principles of Electricity, or college level courses in DC and AC circuits, college algebra and trigonometry. Calculus help, but not required.

8-525. Transistor Electronics

Year, 3 credits each semester OWEN B. LAUG

First semester: Semiconductors and p-n junctions. Transistor construction and characteristics. Small-signal equivalent circuits. Bias stability and thermal considerations. Low frequency and power amplifiers. Second semester: High frequency amplifiers. Noise models. Large-signal equivalent circuits. Transient and steady-state response. Transistors as switches. Logic circuit analysis. *Prerequisites*: Fundamentals of Electronics and mathematics through calculus.

8-485. Evaluation of Electric Power Interconnections—Seminar

Fall, 3 credits

JEROME K. DELSON

Fundamental economic principles as applied to operating and planning electric power systems. Economic evaluation of power system reliability. Theory of marginal cost pricing. *Prerequisite:* Bachelor's degree in engineering or economics.

8-711. Automatic Feedback Control

Fall, 3 credits

JAMES W. TITUS

Designed to develop some capability to analyze and design practical feedback control systems, especially servomechanisms. Principal focus on linear control theory, with some attention to sample-data systems and non-linear systems. Introduction to use of LaPlace transform and Z-transform. Transfer functions of major classes of control system components. Transient analysis and frequency-domain analysis. Stability criteria. Analysis of system performance, emphasizing use of Bode diagrams and root locus method. Choice of parameters to obtain required system performance. *Prerequisite:* Bachelor's degree in engineering or physics, or special permission.

8-407. Radar Systems Engineering

Fall, 2 credits

WILLIAM F. TRISLER

Principal components of radar systems. Interrelations of various parameters that affect radar range. Survey of various types of radar systems. Applicability of these to perform particular tasks. *Prerequisite:* Bachelor's degree in engineering or physical sciences, or equivalent professional experience.

8-690. Nuclear Reactors

Fall, 2 credits

FRED SCHULMAN

Nuclear physics review. Reactor physics. Radioactivity. Types of reactors. Elementary design considerations. Properties of materials related to reactor technology. Biological effects of radiation. Reprocessing of fuels. United States and foreign reactor programs. *Prerequisite:* Bachelor's degree in science or engineering, or special permission.

8-405. Principles of Specifications

Fall, 2 credits

BENJAMIN ROSENZWEIG

Principles underlying Government specifications systems. Survey of procurement documents and their purposes. Organization of specifications for form, clarity, and effectiveness. Evolution and ramifications of specifications with regard to research and development. Legal and contractual relations. Proprietary items. Government inspection. Division of specifications into performance and formulation types. Standardization and industry coordination. *Prerequisite:* Knowledge of procurement, inspection, research, and development processes, or specification writing.

8-411. Critical Path Method of Project Scheduling

Fall, 3 credits

PHILIP L. BRACH

Fundamental concepts of scheduling work activity using critical path method of project scheduling. Three major phases of scheduling: Planning, scheduling, and monitoring and control. Advanced topics introduce use of CPM for scheduling of resources and introduction to statistical approach of PERT method of project scheduling.

8-311. Naval Architecture and Marine Engineering

Year, 3 credits each semester

GEORGE D. KERR

First semester: Lines and offsets, areas, moments, and volumes. Curves of form. Metacentric height and stability. Floodable length. Waves and their effects on ships. Resistance and model testing. **Second semester:** Selection of plant type. Steam plants, Diesel plants. Gas turbine plants. Combined plants. Shafting and propellers. Marine electrical engineering. *Prerequisites:* High school algebra, geometry, and trigonometry.

8-685. Engineering Applications of Digital Computers

Fall, 3 credits. Repeated in Spring

ROBERT S. SMITH

Discussion of types of computing machinery available. Evolution of programming systems as pertaining to engineering applications. Feasibility testing and organization of problems for computer solution. Digital computer methods illustrated with examples taken from various fields of engineering. *Prerequisite:* Bachelor's degree in physical sciences, or comparable experience in field. No computing experience required.

8-730. Introduction to Systems Engineering

Fall, 2 credits. Repeated in Spring

INSTRUCTOR TO BE ANNOUNCED

Designed to provide engineer, technical administrator, or manager aspiring to be member of system-design team sufficient technical background to aid him in his job. Intended to weld many sciences together, present central problem, functions and languages of these sciences, and to furnish practical information on functioning of system-design team. Twelve tools of system design: Probability, mathematical statistics, computing, system logic, queueing theory, game theory, linear programming, cybernetics, group dynamics simulation, information theory, servomechanism theory, and human engineering. *Prerequisite:* Degree in engineering or physics, or special permission.

8-474. Engineering Economics

Fall, 3 credits. Repeated in Spring

STEVE AKERMAN and ROBERT BLUM

Comparison of economic merit of engineering alternatives. Methods applied in various industries and in Federal Government. Present worth, discounted cash flow, payout, and other techniques. Sunk, fixed, and incremental costs. Depreciation and equipment replacement studies. Income taxes in project analysis. Effect of uncertainty in cost and revenue projections. *Prerequisite:* High school algebra desirable.

8-712. Engineering Economic Analysis—Advanced Seminar

Spring, 3 credits

JEROME K. DELSON

Review of Engineering Economics. Capital management under conditions of risk and uncertainty. Economic measurement and forecasting. Some linear programming. "Corporate financial model," tracing by mathematical simulation impact that investment decisions and regulation policy may have on earnings of electric power utility. Case studies. *Prerequisite:* Engineering Economics, or equivalent.

8-406. Engineering Mathematics

Fall, 4 credits. Repeated in Spring

ALAN O. PLATT

Designed to provide the engineering student with awareness of mathematical methods useful for application to engineering problems. Introduction to advanced topics for the student who wishes to go further. Material includes matrices and determinants, differential equations, partial differential equations, vector analysis, complex variables, Bessel functions, Legendre polynomials, Gamma function, Fourier analysis, Laplace transform, and function integrals, as time permits. *Prerequisites:* Differential and integral calculus.

3-546. Application of Differential Equations to Engineering Theory (See P. 43)

8-695. Engineering Reliability

Year, 2 credits each semester

H. WALTER PRICE

Designed for the engineer desiring to acquire comprehension of reliability concepts and to develop working knowledge of reliability techniques. Basic probability and statistics pertaining to reliability. Failure, survival, and failure rate functions. Exponential distribution. Weibull distribution. Gamma distribution. Evolutionary or response-surface techniques. Stress domains. Reliability effects of temperature, shock, vibration, humidity, and electrical stresses. System reliability. Probabilistic environmental-encounter and use-encounter analyses. Design parameter analysis. Design reliability. Specification reliability index analysis. Circuit reliability analysis. Reliability of parallel circuits. Mean-life of parallel elements. Probe test. Manufacturing reliability. Life-testing. Accelerated life-testing. Type B value engineering. Economic decision method. Maintainability. Optimum search techniques. Optimum module size. Availability. Logistics. Use of models and games to illustrate concepts. Solution of simulated reliability problems in class. Discussion of specific reliability problems submitted by students. *Prerequisite*: Degree in engineering, or special permission.

8-710. Steam Power Plants

Year, 3 credits each semester

JOHN L. RUSS

Design and construction of modern-day steam power plant and associated operations. Maintenance and economic considerations. Emphasis on present and future power generation requirements. Unit design. Plant design. Fuels. Steam generators and auxiliary equipment and specific fuel applications. Piping design fabrication and layout. Water technology. Turbine generators and auxiliary and control equipment. Electrical systems and equipment including protection. Control and information handling systems, including data logging. Power plant auxiliary equipment such as condensers, heat exchangers, and pumps. Standards. Operations. Engineering supervision, inspection, and performance testing. *Prerequisites*: Engineering degree or equivalent experience, preferably including basic course in thermodynamics.

8-714. Heating, Ventilating, and Air Conditioning

Fall, 3 credits. Repeated in Spring

GERALD M. HOLLANDER

Study of factors contributing to heat gain and heat loss in buildings. Psychometric principles. Comfort conditions. Heating systems. Air flow. Fans. Fan laws. Duct systems. Cooling, dehumidification, and refrigeration systems. Piping. Zoning and controls. Principles of design and system selection. System components including refrigeration side, air side, and heat rejection equipment. Problems developing during construction and balance and test period. *Prerequisite*: Engineering degree, or equivalent experience.

8-720. Site Selection and Engineering

Fall, 2 credits

CHESTER J. FUNNYÉ

Basic theory and general principles of civil engineering relating to selection and development of project sites. Identification and solution of siting problems encountered in airport development, highway traffic structures, hydro projects, steam electric power plants, and industrial and commercial buildings. Special studies of substructures, including footings, pile foundations, mats, retaining structures, and underground construction such as tunnels. *Prerequisite*: Degree in engineering or architecture, or experience in construction.

8-348. Introduction to Urban-Regional Planning

Fall, 3 credits

PAUL B. BRACE

Study of man in shaping his physical settlements as part of his whole environment. To assist the student to become a better informed citizen, to aid his work in collateral professions, or to better

fit him to assume active civic responsibilities. Introduction of historical material, technical concepts, and theories although not history of urban-regional planning. Not a technical course.

8-697. Highway Location and Design

Fall, 3 credits

FOREST H. GREEN

Basic principles of highway location, including recognition of topographic and cultural influences and application of road-use analyses. Use of airphoto interpretation methods, photogrammetry, and ground-reconnaissance surveys. Development of curvilinear alignments. Development and general application of geometric design standards, with special emphasis on freeway design. *Prerequisite:* Degree in civil engineering, or special permission.

8-698. Traffic Planning and Operations

Spring, 3 credits

FOREST H. GREEN

Urban traffic patterns. Traffic surveys and traffic volume predictions. Traffic assignment to proposed facilities and development of design volumes. Principles of traffic operations, including use of one-way streets, signals, and local improvements. Organization and operation of traffic engineering departments. *Prerequisite:* Degree in civil engineering, or special permission.

8-735. Ultimate Design in Concrete and Plastic Design in Steel

Fall, 3 credits. Repeated in Spring

ROBERT L. NICKERSON and FRANK D. SEARS

Designed to acquaint structural engineers with theory and design procedures used in ultimate strength concept of concrete design and plastic design concept in structural steel. Half of course concerned with concrete and half with structural steel. *Prerequisite:* Degree in civil engineering, or special permission.

8-446. Space Flight

Fall, 3 credits

M. MICHAEL CUTLER

Designed to provide understanding of basic laws governing space flight and technology, permitting and limiting operation in space. Ballistic, orbital, and planetary flight, with examples from United States space program. Technology and systems used to implement space flight, including launch vehicles, rocket propulsion systems, power systems, guidance and navigation systems, communications, and structures and reentry. Upon completion, the student can make elementary calculations of mission flight and major systems requirements. *Prerequisites:* College algebra and physics.

8-736. Metals and Alloys for Space Technology

Year, 2 credits each semester

BLAKE M. LORING

First semester: Review of necessary metallurgy. Requirements for space materials. Light metals such as aluminum and beryllium and high temperature resisting alloys of tungsten, molybdenum, and stainless steel. Second semester: Review of necessary metallurgy. New fabrication techniques including high strength filament winding, chemical milling, explosive forming, spray processing, and special forging and extrusion. Materials problem of reentry. Examples from Apollo, Saturn, and Minuteman. *Prerequisite:* Degree in engineering, or special permission.

5-745. Principles of Masers and Lasers (See P. 67)

6-507. Governing Science and Technology (See P. 76)

Surveying and Mapping

COMMITTEE

G. C. Tewinkel, *Chairman*

William J. Blackburn, III, D. A. Bucci, John W. Cain, James M. Cultice, Walter S. Dix, James P. Fondren, S. J. Friedman, Leon J. Kosofsky, William C. Mahoney, Robert B. Mercready, W. R. Nunn, Jr., J. Robert Porter, Jr., Rupert B. Southard, Jr., Charles A. Whitten, Marshall S. Wright, Jr.

The field of transportation, whether by land, sea, or air presupposes the existence of navigational charts based on accurate geodetic surveys. The planning and construction of our public roads system, as well as pipe lines, transmission lines, and canals, are based on accurately prepared engineering plans. These depict the surface of the ground in three dimensions and contain all the surface and subsurface information that affects the economy of the operations. The reliability of charts and plans relates to probability, statistics, error analyses, and sampling to maintain the cost and accuracy of the plan in proper balance with the total cost of the facility.

Satellites offer a new method for geodesists to determine the actual shape of the earth. Electronics offers new systems for distance measurement and new vistas of automation. Photogrammetry offers a modern tool for expediting topographic mapping. Cartography recognizes modern navigational needs by altering the appearance of its products to conform to new speeds, new instruments, and new vehicles. All these topics relate to applied physics and mathematics. A proper understanding of these ideas is important in the relationship of the specific function of a map-maker to the total field. The following curriculum is designed to assist the inquisitive map-maker in acquiring this understanding.

CERTIFIED STATEMENTS OF ACCOMPLISHMENT IN SURVEYING AND MAPPING

Certified Statements of Accomplishment in Surveying and Mapping are granted to the undergraduate and advanced student who complete organized courses of study intended to provide basic training for responsible work in surveying and mapping.

Certified Statement of Accomplishment—Undergraduate

The program leading to the Undergraduate Certified Statement of Accomplishment in Surveying and Mapping provides training approximately equivalent to that gained from a year of technical college work. Graduation from high school is the minimal educational background required, but some college work is desirable.

Requirements (32 credits)

1. Required prerequisite courses:

College algebra
Trigonometry

2. 27 semester hours of credit with a grade of C or better in each of the following courses:

Aerial Photographic Interpretation (3)
Applications of Mathematics to Surveying and Mapping (3)
Basic Photogrammetry I (3)
Basic Photogrammetry II (3)
Cartographic Techniques and Map Reproduction (3)

Cartography I (3)
Elementary Surveying (3)
Map Projections and Grid Systems (3)
Topographic Surveying (3)

3. 5 semester hours of credit with a grade of C or better in courses selected from related electives listed under the Advanced Certified Statement of Accomplishment.

Certified Statement of Accomplishment—Advanced

The program leading to the Advanced Certified Statement of Accomplishment in Surveying and Mapping provides training at least at the level of the master's degree. Although neither certified statement requires any specified work at the college level, the student is reminded that completion of courses in the broader and nontechnical subjects integral to the standard college curriculum is an important part of his general preparation for responsible work in this profession.

Requirements (30 credits)

1. Required prerequisite courses:

College algebra
Trigonometry
Analytic geometry
Calculus

2. 21 semester hours of credit with a grade of B or better in each of the following courses:

Advanced Photogrammetry I (3)
Advanced Photogrammetry II (3)
Applied Cartography (2)
Astronomy for Engineers (3)
Computation and Adjustment of Geodetic Observations (3)
Geodetic Surveying (3)
Editing Technical Manuscripts (2)
Official Writing or Technical Writing (2)

3. 9 semester hours of credit with a grade of B or better selected from the following related electives, or 17 semester hours if both certified statements are received.

Advanced Aerial Photographic Interpretation (3)
Applied Electronic Theory (6)
Computer Graphics, Theory and Application (2)
General Geology (3)
General Meteorology (3)
General Oceanography (2)
Historical Geology (3)
Maps and Charts (2)
Official Writing (Undergraduate only) (2)
Remote Sensing (3)
Route Surveying (3)
Theory of Errors (3)

Equivalent courses will be accepted by transfer from other colleges and universities. An applicant for either certified statement must file a transcript of his high school or college record before completion of his program.

Surveying

8-132. Introduction to Geodesy

Fall, 2 credits

CHARLES A. WHITTEN

Series of lectures designed to acquaint the student with many general topics involved in geodesy and the space age, with particular emphasis on modern thinking and methods. Use of mathematics minimized to fit capabilities of a particular class. Nevertheless, mathematical principles through trigonometry desirable and helpful. Topics include: Some elements of plane and spherical trigonometry. Figure of earth. Principles of motion and gravity. Triangulation, trilateration, geodetic leveling, gravimetry, astronomic observations, azimuth, and earth magnetism. Geodetic datums. Solar eclipses. Geodetic satellites. Some geometric problems encountered in lunar mapping, instruments, and methods.

[8-135.] Elementary Surveying (1971-72 *and alternate years*)

Fall, 3 credits

WILLIAM J. BLACKBURN, III

Use of transit, level, compass, and accessory equipment. Adjustment of instruments. Field methods of transit-and-tape traverse and engineers' leveling (differential and profile). Computations connected with above including adjustment of traverses by compass and transit rules. Computation of latitudes, departures, and areas. Lectures, classroom work, and field work. *Prerequisite*: Plane trigonometry.

[8-204.] Ground Methods of Topographic Surveying (1972-73 *and every third year*)

Spring, 3 credits

WILLIAM J. BLACKBURN, III

Stadia method. Mapping with transit. Plane table mapping. Plane table triangulation and special problems. Methods and practices in map construction. *Prerequisite*: Elementary Surveying.

8-215. Route Surveying (1970-71 *and every third year*)

Fall, 3 credits

WILLIAM J. BLACKBURN, III

Theory and practice of surveying for railroads, highways, and canals. Preliminary and location surveys, cross sections, earthwork quantities, and transition spirals. Lectures, classrooms, and field work. *Prerequisites*: Elementary Surveying and plane trigonometry.

8-217. Astronomy for Engineers (1970-71 *and every third year*)

Spring, 3 credits

WILLIAM J. BLACKBURN, III

Fundamentals of circular systems. Basis of determination of time, longitude, latitude, and azimuth. Use of instrumental equipment. *Prerequisite*: Elementary Surveying.

8-210. Practical Astronomy

Spring, 2 credits

ARMANDO MANCINI

Elements of celestial sphere. Atmospheric refraction. Meridian circle. Planetary motions. Sidereal time. Aberration. Parallax. Precession and nutation. Proper notions of stars. Astronomic photography. *Prerequisite*: Plane trigonometry.

[8-218.] Geodetic Surveying (1971-72 and every third year)

Fall, 3 credits

WILLIAM J. BLACKBURN, III

Theory and practice of first- and second-order triangulation, traverse, and leveling. Use of base-line equipment, repeating and direction theodolites, and geodetic leveling equipment. Field computations necessary to insure accuracy of observations. *Prerequisite*: Elementary Surveying, or special permission.

[8-219.] Computation and Adjustment of Geodetic Observations (1971-72 and every third year)

Spring, 3 credits

WILLIAM J. BLACKBURN, III

Office procedures in final computation and adjustment of field observations introduced in Geodetic Surveying. Least square approach to adjustment of networks of traverse and leveling and simple triangulation figures. *Prerequisite*: Geodetic Surveying, or equivalent, or special permission.

Photogrammetry

8-120. Introduction to Photogrammetry

Spring, 2 credits

ROBERT B. McEWEN

Lectures and demonstrations in simple terms. General knowledge of photogrammetry: History, simple optics, fundamental photographic principles, types of aerial cameras, accessories, and materials of photographic aircraft. Topographic mapping by photogrammetry, photointerpretation, geodetic control requirements for photogrammetry, extension techniques for control, and basic instrumentation for photogrammetry. Current developments and future aspects of photogrammetric science.

8-251. Basic Photogrammetry I

Fall, 3 credits

DEAN T. EDSON and ROY R. MULLEN

Basic theory of photogrammetry. Elements of photogrammetric optics. Geometry of aerial photographs. Aerial cameras and accessories. Elements, instrumentation, and materials of photography. Principles of flight planning. Field surveys for photogrammetry. Radial line methods for control extension and plotting. Stereoscopy and parallax. Mosaics and photointerpretation. *Prerequisite*: Training in engineering, or aerial photography, or geology, or forestry, or geography.

8-252. Basic Photogrammetry II

Spring, 3 credits

DEAN T. EDSON and ROY R. MULLEN

Continuation of basic photogrammetric theory and practice. Geometry of tilted photographs. Principles of stereophotogrammetry. Theory and design of stereoscopic plotting instruments. Photogrammetric control extension techniques. Stereoplotting. Techniques for oblique photogrammetry. Current developments in photogrammetry. Future trends. *Prerequisite*: Basic Photogrammetry I, or equivalent.

8-480. Advanced Photogrammetry I

Fall, 3 credits

MORTON KELLER

Statistics for photogrammetry: Method of least squares, elementary sampling theory. Elements of matrix algebra. Principles of FORTRAN programming for digital computers. Introduction to analytical photogrammetry. Correction of image coordinates for systematic errors. Formulation for analytic photogrammetry: Rotational elements and development of universal (resection) formulas. *Prerequisite*: Basic Photogrammetry II and first semester of Calculus, or equivalent.

8-481. Advanced Photogrammetry II

Spring, 3 credits

MORTON KELLER

Analytic relative orientation. Computational strip adjustment. Secant plane coordinate transformation. Resection. Simultaneous least squares orientation for large blocks. Object intersection. *Prerequisite*: Advanced Photogrammetry I.

8-208. Aerial Photographic Interpretation

Fall, 3 credits

THOMAS C. CHISNELL

Principles, techniques, and applications of aerial photographic interpretations. History, concepts, types of aerial photographs, principles, techniques, and applications. Study, and use in various fields, of aerial photographs as source of detailed natural and cultural information. *Prerequisite*: General background in one of the following—surveying and mapping, cartography, geography, geology, forestry, agriculture, architecture, or allied engineering fields.

8-408. Advanced Aerial Photographic Interpretation

Spring, 3 credits

THOMAS C. CHISNELL

Seminar on application of aerial photographic interpretation to specialized technical fields, such as forest, range, and wildlife management. Agricultural soil, engineering soil, and vegetation surveys. Geology and petroleum geology. Population census in rural and urban areas. *Prerequisite*: Basic training in aerial photographic interpretation. Training in forestry, range management, wildlife management, agriculture, ecology, geography, geology, or engineering desirable.

8-414. Lunar and Planetary Photography and Photogrammetry

Fall, 2 credits

DONALD L. LIGHT and LEON J. KOSOFSKY

First half of semester: Special circumstances governing acquisition of lunar and planetary photography. Orbital tracks in relation to coverage, scale, and solar illumination requirements. Attitude control. Image motion compensation. Place of film in relation to other stories media. Readout and transmission of photographs. Second half: Special problems encountered in recovering geometry of telemetered photography. Coordinate transformations and selected methods available for solving photogrammetric applications of lunar and planetary photography.

8-427. Remote Sensing

Fall, 3 credits

ROBERT B. McEWEN

Theory and application of remote sensing. Electromagnetic spectrum, environmental effects, sensors, data recording, and analysis. Photographic systems, infrared scanners, scatterometers, radar, and radiometers. Practical consideration and review of current satellite and aircraft earth resource investigations. *Prerequisite*: Some background in engineering, photogrammetry, or natural science helpful.

3-508. Theory of Errors

(See P. 44)

Cartography**8-125. Cartography I**

Fall, 3 credits. Repeated in Spring

WILLIAM A. FOSTER

Designed for layman, beginner, technician, and cartographer working solely in specialized facet of cartography. Introduction to all phases of broad field of cartography in simple terms. History of

maps. Size and shape of earth. Common projections. Elementary plane and geodetic surveying. Topography. Hydrography and bathymetry. Photogrammetry. Oceanography. Classification. Evaluation, compilation, construction, and revision of maps and charts. Methods and techniques of reproduction. Surveying by electronic methods. Course can be utilized by technicians as partial requirement for cartographer rating.

2-114. Maps and Charts (See P. 32)

8-240. Cartographic Techniques and Map Reproduction

Fall, 3 credits. Repeated in Spring

ANTHONY S. BASILE

Factors, commensurate with scale, to be considered before designing a chart or map for reproduction. Selection of reproduction process. Shaping of job for selected process. Reproduction support during the compilation stage. Types of line and half tone copy. Types of media used for line, half tone, and scribed originals. Color separations. Relief techniques. Reproduction techniques utilized in correcting chart/map to date. Cartographic typography. Photolithography, letter press, gravure, ozalid, and photogelatin processes, including historical background. Demonstrations of cartographic and reproduction techniques utilized by U. S. Naval Oceanographic Office, Coast and Geodetic Survey, Army Map Service, U. S. Geological Survey, and National Geographic Society, including historical background. Estimating man-hour costs. *Prerequisite*: Cartography I, or special permission.

8-226. Applications of Mathematics to Surveying and Mapping

Fall, 3 credits

CHARLES E. COOK

Designed to train the student in applying many principles of mathematics to surveying and photogrammetry. Access to desk calculator highly recommended because of exercises involved. *Subjects*: Distance and direction. Traverse and triangle computations. Geodetic and plane coordinates. Line slope and tangent formulas. Elementary application of solid analytic geometry and differential calculus. Spherical trigonometry. Least squares routine. Elementary matrix algebra operations. *Prerequisites*: College Algebra and Trigonometry.

8-223. Map Projections and Grid Systems

Fall, 3 credits. Repeated in Spring

ANTHONY S. BASILE

Designed for cartographers and map research or intelligence specialists. Basic principles, computations and layout methods, definitions, classifications, characteristics, and identification methods. Coordination of systems in present day use, including rectangular, broad area, and true military grid and applications of programming to cartography. Plotting and constructing map projections and grid systems by automated techniques. Methods of displaying shoreline and plotting date on any type map projection by ADP.

8-455. Computer Graphics: Theory and Application

Fall, 2 credits. Repeated in Spring

ROBERT B. MERCREADY

Use of computers to produce quantitative maps through technique called Synagraphic Mapping System (SYMAP). Technique developed at Harvard University and applied to wide variety of problems dealing with diverse spatially-distributed information. The student will develop programming skills required to correlate statistical data onto map outputs and to work transformations on coordinate (essentially digitized) inputs. The student will develop and run his own map program with minimal extra cost for keypunch and computer time. *Prerequisites*: Fortran IV programming skills and knowledge of statistical analysis desirable but not required.

5-414. Celestial Navigation (See P. 70)

Fine and Applied Arts

COMMITTEE

Donald R. McClelland, *Chairman*

Sadye F. Adelson, Garnet W. Jex (*Vice-chairman*), Anita M. Laird, George E. Muth, Leonard C. Rennie, Warren M. Robbins, Wolf Von Eckhardt, Karel Yasko

The courses offered in the fine and applied arts are of general interest.

CERTIFIED STATEMENT OF ACCOMPLISHMENT IN THE GRAPHIC ARTS

A Certified Statement of Accomplishment in the Graphic Arts is granted to a student who has completed an organized course of study designed to provide basic training in this field. The student may concentrate in a specialized area: Exhibit, layout, illustration, or some other area of the graphic arts. Graduation from high school, or the equivalent, is the minimal educational background required. An applicant for the certified statement must file a transcript of his high school or college record before completion of his program.

Requirements

1. Ability to meet problems of visual communications with creative and practical graphic solutions. This requirement can be demonstrated by taking appropriate courses listed under the electives.
2. 20 semester hours of credit with an average grade of B or better in the following courses:
 - a. Required courses (16 credits)
 - Graphic Arts in Federal Government (4)
 - Art, Layout, and Design for Reproduction (2)
 - Creative Illustration (2)
 - Design in Visual Communication (2)
 - Dimensional Design (2)
 - Layout in Visual Communication (2)
 - Printing, Layout, and Design (2)
 - b. Electives (4 credits)
 - Anatomy of Creative Art (2)
 - Cartography I (2)
 - Creative Expression from Life (2)
 - Creative Photography through Composition I (2)
 - Introduction to Creative Expression (2)
 - Life Sketching (2)
 - Modern Art (2)
 - Modern Supervisory Practice (2)
 - Oil Painting (2)
 - Pencil Sketching and Water Color Painting (2)
 - Portrait Painting in Oil (2)
 - Photojournalism (2)
 - Production and Management of Graphics (2)
 - Sculpture (2)
 - Survey of Lithography (3)
 - Writing for Audio-Visual Communication (2)

Other courses may be approved depending upon the needs of the student, particularly in a subject-matter area.

A student seeking this certified statement should consult with the Registrar and obtain approval of his proposed course of study early in his academic program. Equivalent courses will be accepted by transfer from other institutions.

Fine Arts

8-320. Pencil Sketching and Water Color Painting

Fall, 2 credits. Repeated in Spring and Summer

JAMES V. CUPOLI

Informal course in theory and practice of pencil sketching and ways and means of water color. Demonstration in both media. The student may use either or both media. For the beginning and advanced student.

8-351. Oil Painting

Fall, 2 credits. Repeated in Spring

JAMES V. CUPOLI

Still life and landscape painting. Oil and acrylic painting. Demonstrations in both media. For the beginning and advanced student.

8-332. Introduction to Creative Expression

Fall, 2 credits

DUANE A. MCKENNA

For the student without previous art training who seeks personal enrichment or pleasure of self-expression through art.

8-321. Creative Expression from Life

Spring, 2 credits

DUANE A. MCKENNA

Art workshop for practical skill and pleasure in varied media according to needs and desires of the student. Emphasis on individual development through personal experience and observation. *Prerequisite*: Basic drawing, or equivalent.

8-338. Life Sketching

Fall, 2 credits. Repeated in Spring

JAMES V. CUPOLI

Life and figure sketching of human figure. Painting of figure for the beginning and advanced student.

8-355. Creative Painting

Fall, 2 credits. Repeated in Spring

BENJAMIN ABRAMOWITZ

Workshop stressing individual work for the student at each stage of development. Direction in organizing natural and imaginative forms, with emphasis on expressive possibilities of color and composition. Orientation in contemporary painting techniques. Discussions, analysis, and demonstrations leading to development of critical values. Preparation, care, and use of materials. Framing and exhibition procedures. Indoor and outdoor painting sessions. No previous training necessary.

8-366. Anatomy of Creative Art

Fall, 2 credits. Repeated in Spring

ABNER B. COHEN

Lecture analysis and workshop development of pertinent components of creative design. Cogent elements revealed in works of classic, modern, and contemporary artists. As basic concept is mastered, the student creates progressive aesthetic motifs in line, tone, and color, and learns to paint expressions in realistic, abstract, or contemporary techniques. Workshop and home assignments given individual criticism and direction. *Prerequisite*: Active interest in art development.

8-371. Sculpture

Fall, 2 credits. Repeated in Spring

ERIC RUDD

Fundamentals of sculpture. Analysis of volume and space. Studio work stressing contemporary concepts and materials through use of cardboard, clay, plastics, plywood, styrofoam, wire, and wire screen. Basic equipment provided. No experience necessary.

8-245. Pottery

Fall, 2 credits. Repeated in Spring and Summer

JILL HINCKLEY

Beginning course in throwing on the wheel, hand building, glazing, firing, and tool making in fully equipped pottery studio.

8-333. Art Appreciation

Fall, 3 credits. Repeated in Summer

JILL HINCKLEY

Basic fundamentals. Line. Color. Composition.

8-368. Beginnings of Modern Art

Fall, 3 credits

ELIZABETH B. NIGHTLINGER

Explores background of modern art from neoclassicism and romanticism through impressionism and post impressionism. Slide lectures and field trips.

8-369. Contemporary Art: Its Sources

Spring, 3 credits. Repeated in Summer

ELIZABETH B. NIGHTLINGER

Explores development of today's art from expressionism, cubism, and surrealism through abstract expressionism, pop, op, minimal, and now. Slide lectures and field trips.

8-336. American Art

Spring, 3 credits

PENELOPE C. STARR

American art from colonial times to present. Emphasis on painting, with some attention to sculpture, architecture, photography, and folk art. *Prerequisite:* Survey of art course desirable, but not essential.

8-372. African Art and Culture

Fall, 2 credits. Repeated in Summer

WARREN M. ROEBINS and ASSOCIATES

Survey covering traditional and contemporary art, music, dance and textiles of Subsaharan Africa. Also, impact of African sculpture on modern Western art.

8-354. Problems in Contemporary Urban Development

Fall, 3 credits. Repeated in Spring

LINDA VAN SWEDEN

Social, economic, and physical growth of cities since 1800. Impact of industrial revolution, traffic patterns, building techniques, and economic boom. Half class time for field trips to garden cities, planned new towns, renewal areas, thriving metropolitan centers, and redevelopment areas. Prediction of future urban patterns within United States.

8-352. Architecture of Washington, D. C.

Summer, 2 credits

LINDA VAN SWEDEN

Designed to acquaint the student with architecture of unique Federal city as constructed from time of founding in 1790. Walking trips to examine buildings of major significance, details that

characterize various architectural periods, and importance in architectural development of city as whole. Washington as one of few American examples of continuity in city design. Basic city plan of Pierre L'Enfant followed closely since 1792. Continuous efforts by individual architects to main high standards of design.

8-364. Potomac Valley Architecture

Fall, 3 credits. Repeated in Spring

LINDA VAN SWEDEN

Tours of buildings making up Tide Water and Potomac Valley heritage in architecture. Comprehensive study of growth of architectural styles in Maryland and Virginia from 1650 to present as related to other American building development and to architecture of nation's capitol. No prerequisite, but natural continuation of Architecture of Washington, D. C.

8-339. Architectural Graphics

Fall, 3 credits

DONALD B. FLEDGER

Condensed course in principles of multi-view, paraline, and perspective drawing systems. Emphasis on one- and two-point perspective relative to presentation drawing and renderings.

8-370. Music Appreciation

Fall, 3 credits. Repeated in Spring

JOHN SHORTRIDGE

Designed to develop ability to enjoy music through study of musical styles, forms, and instruments of various periods. Consideration of changing role of music in society through the ages. Recordings and live performances.

8-445. Music Theory

Year, 3 credits each semester

JOHN SHORTRIDGE

First semester: Rudiments of music including major and minor scales, key signatures, and intervals. Traditional harmony—four part writing using triads, seventh chords, inversions, non-chord tones, and simple altered chords. Harmonic analysis. Second semester: Ear training including interval recognition, melodic and harmonic dictation, and sight reading. The two semesters may be taken separately or out of sequence although the student is urged to take both in sequence for maximum benefit. *Prerequisite*: Some ability to read music in bass and treble clefs.

8-359. Sources of Theater

Fall, 2 credits

DONALD J. WATERS

Chronological study of major periods of theatrical activity from ancient to modern times. Consideration of playwrights, actors, designers, directors, and critics who have influenced drama. Plays read and discussed as representative of periods in which they originated.

8-363. Contemporary Theater

Spring, 2 credits

DONALD J. WATERS

Designed to develop appreciation and judgment of all arts of theater to make theater-going more meaningful. Consideration of plays, playwrights, actors, directors, scenic artists, and critics of twentieth century. *Prerequisite*: Sources of Theater, or equivalent.

8-373. Motion Picture Appreciation

Fall, 2 credits. Repeated in Spring

PAUL SPEHR

Aesthetic approach to cinema. Designed to stimulate and develop cinema judgment. Great masters and their films. Current motion picture scene. Lectures, classic films, and movie-going.

*Applied Arts***8-35. Introduction to Institutional Housekeeping**

Fall, non-credit

EMMA MORGAN and ASSOCIATES

Introduction to fundamentals of institutional housekeeping for hotels, hospitals, motels, college dormitories, fraternity and sorority houses, and similar institutions. Basic principles of the work. Attractive to the woman planning another type of job when the younger generation is challenging her position. Field trips and demonstrations.

8-36. Institutional Housekeeping II

Spring, non-credit

EMMA MORGAN and ASSOCIATES

Further study of rapidly expanding field. Rules and practices of many varied duties of Executive Housekeeper and scope of operation of institution's housekeeping department. *Prerequisite*: Introduction to Institutional Housekeeping, or practical experience in a supervisory capacity.

8-55. Introduction to Interior Design

Fall, non-credit. Repeated in Spring

SUSAN A. MEYER

Study of practical problems of interior decoration, with special emphasis on architecture of interior, functional layout of furniture, and coordination of ensemble. Illustrations of color schemes, fabrics and drapery types, lighting, and use of accessories.

8-144. Graphic Arts in Federal Government

Year, 2 credits each semester

 MAURICE H. EYSENBERG
 WILLIAM WILSON TAYLOR
 HARRY J. WIENER

Introductory survey of field of graphic arts in the Federal Government. For practicing artists, designers, and others concerned with preparation and use of visual materials in many media. Classroom lectures and demonstrations, discussion, and analysis of homework by staff and visiting experts

8-146. Creative Illustration

Fall, 2 credits. Repeated in Spring

A. MICHAEL AULD

Basic design and construction of modern-day illustration. Emphasis on professional methods. Classroom lectures with demonstrations, discussion, and analysis of homework. *Prerequisites*: Active interest in home assignments and background in drawing helpful.

8-322. Art, Layout, and Design for Reproduction

Fall, 2 credits

DAVID M. GRANAHAN and WILLIAM WILSON TAYLOR

Planned to help administrators, editors, educators, graphic personnel, and writers to prepare and use communications materials more effectively.

8-145. Layout in Visual Communication

Spring, 2 credits

MAURICE H. EYSENBERG

Theory and practice of layout as key to visual communication, including chart, poster, printed page film, exhibit, and other. Classroom demonstration, discussion, and analysis leading to home assignments for practice and application of basic rules. *Prerequisites*: Fair ability to draw, familiarity with lettering and typography, sense of design, and reproductive processes and media related terminology.

8-140. Dimensional Design

Fall, 2 credits. Repeated in Spring

GEORGE L. BAKA

Advanced training in design of three-dimensional forms. Principles in composition of these forms. Line, plane surface, color, material, and space as coherent whole. Insight into creative and more complicated processes involved in third dimension. Analysis of treatment of materials and equipment in fabrication of actual forms. Examination to provide methodical approach to problems.

8-142. Exhibit Graphics and Fabrication

Fall, 2 credits. Repeated in Summer

JAMES W. SCHLEYER

Consideration mainly of exhibits, but with application to other fields of design. Graphics. Typography. Photography. Variety of techniques. Exhibit design. Construction. Animation. Materials. Specifications. Contracting.

2-243. Design in Visual Communication (See P. 30)

8-141. Production and Management of Graphics

Fall, 2 credits. Repeated in Spring

JAMES L. HOPEWELL and WILLIAM WILSON TAYLOR

Designed to assist personnel in visual and related fields of communications to understand problems in production procedures and management of graphics. Television, publications, multi-media programs, work flows, editing, proofing, supporting art, linotyping, engraving, and other materials used to complete project from rough idea to finished program.

8-284. Introduction to Landscape Architecture

Fall, 2 credits

DONALD B. PLEDGER

Theory and principles of design and design process. Concepts of space allocation, enclosure, orientation, privacy, and environment. Introduction to materials and techniques, including earth forms, grading, and drainage. Emphasis on small residential properties and urban landscape.

8-285. Landscape Use of Trees, Shrubs, Vines, and Flowers

Spring, 2 credits

DONALD B. PLEDGER

Principles of landscape design, with emphasis on plant materials as one of major design elements. Classification of plants by both horticultural and design characteristics. Discussion of plant ecology and plant associations, identification techniques, and other relevant topics. *Prerequisite*: Introduction to Landscape Architecture, or equivalent.

Photography and Lithography

COMMITTEE

Milton A. Ford, *Chairman*

Thomas J. Beavers, Jr., Charles J. Bensberg, Raymond Davis, Arthur L. Gaush, Fred W. Gerretson, Julius Halsman, R. J. Lefebvre, Albert R. Materazzi, Elbridge C. Purdy, William J. Rankin, Frank J. Scherschel, Eugene D. Scialdone, William F. Watson

Advances in the use of light sensitive materials in the arts and sciences and in industry have caused demand for new and refresher training in the fields of photography and lithography. The development of the printing arts has similarly opened up new areas of training. The following courses are intended to meet these and other related

needs. The courses are designed to furnish basic technical information applicable to all areas. They also develop special skills for particular applications. Finally, they try to satisfy special requirements within the photographic and allied industries.

8-70. Introduction to Photography

Fall, non-credit. Repeated in Spring and Summer

NORMAN LEE McCULLOUGH

Nontechnical demonstration course. Designed for camera enthusiasts desiring to understand how their cameras, films, and prints work. Camera types and operation. Film types and uses. Developing and printing. Filters. Exposures. Planning, composition, and lighting. Portraiture. Motion pictures. Color photography. Exhibition and demonstration of equipment, materials, and techniques.

8-192. Fundamentals of Photography I

Fall, 2 credits. Repeated in Spring

FRANKLIN D. PEELE
RICHARD SZELUGA

Scientific principles of photography. Foundation for more advanced courses in photography. Nature of photographic process. Factors in development, fixing, and washing. Light as applied to photography. Lenses, image formation, and judging exposure. Effects of lighting on pictorial rendition of objects. *Prerequisite:* Introduction to Photography, or equivalent.

8-193. Practice of Photography I

Fall, 3 credits. Repeated in Spring

WILLIAM T. FULLER
JACK S. SCHNEIDER

Laboratory practice and demonstration of principles taught in Fundamentals of Photography I. It offers the student opportunity to become familiar with recommended procedures and techniques. Contact printing and processing. Selection of printing papers. Processing of negative roll film, cut film, and film pack. Diagnosis and remedy of processing defects. Types of cameras, their operation and uses, and application of filters.

8-195. Fundamentals of Photography II

Fall, 2 credits. Repeated in Spring

ALBERT R. MERRITT

Theory to obtain good negative by controlled exposure and development. Principles of projection printing. Proper selection and utilization of darkroom equipment. Quality control procedures in everyday photography. Photo-sensitive materials. Use of exposure meter. Functions of light filters. Types of lighting. Science of sensitometry to measure and control photographic process. *Prerequisites:* Fundamentals of Photography I and Practice of Photography I, or equivalent.

8-196. Practice of Photography II

Fall, 2 credits. Repeated in Spring

WILLIAM T. FULLER

Projection printing. Application of sensitometric measurements. Print correction. Composite printing. Use of variable contrast papers. Lighting. Rendition of form and texture. Light patterns. Effect of light on color, toning, and print quality analysis. *Prerequisites:* Fundamentals of Photography I, Practice of Photography I, and Fundamentals of Photography II. May be taken concurrently with Fundamentals of Photography II. *Each student must have access to outside laboratory facilities.*

8-360. Portrait Photography

Year, 2 credits each semester

ELDRIDGE C. PURDY

Studio and darkroom course with opportunity for practice. The student learns through individual guidance the subtleties of fine portrait work. Lighting, posing, composition, processing, and retouching. *Prerequisite:* Practice of Photography II.

8-270. Color Photography and Printing

Year, 3 credits each semester

OSCAR RODEBELL
JAMES H. TROTT

Basic theory and practice in making color prints on positive color materials and negative color materials. Lectures: Basic theory, nature of color and light, three-color theory, formation of colors, additive and subtractive processes, color temperatures, and transmission and absorption of filters. Laboratory: Selection of equipment, evaluation of transparencies and color negatives, proper exposure controls, mixing of chemical solutions, controls in color processing, and practical applications of these fundamentals. *Prerequisite*: Background in black and white photography and 4- \times 5-inch color negatives for practical application in laboratory, or special permission.

8-294. Chemistry of Photographic Process

Fall, 3 credits

ANTHONY E. SALERNO

Proper procedures for conducting experiment and writing technical report. Fundamentals of general chemistry and chemistry of photographic process. Emulsion manufacture, solution formulae, analytical procedures, and other related chemistry. Laboratory equipment, glassware, and apparatus. Their role, handling, and technique. Replenishment programs. Other primary control procedures.

8-295. Mechanics and Kinetics of Photographic Process

Spring, 3 credits

ANTHONY E. SALERNO

Light, optics, and photometry. Photographic sensitometry, densitometry, and related mechanics and control of their photographic process. Anomalies such as bromide drag, adjacency effect, Clayden effect, Herschel effect, Alberts effect, Sabbattier effect, and others. Tone reproduction, image enhancement, density slicing, automatic dodging, and other unique photographic phenomena.

8-194. Creative Photography through Composition I

Fall, 2 credits

MARTIN H. MILLER

Practical help for beginner as well as experienced photographer. Intended to develop understanding of composition and design. Practice in applying to the photographs of the student elements of composition that make superior pictures. Criticism and suggestions on prints and color slides. Course applies to color slides, color prints, and black and white photographs. Discussion of original photographs by outstanding pictorial and photo-journalist photographers. Field trip.

8-197. Creative Photography through Composition II

Spring, 2 credits

MARTIN H. MILLER

Continuation of Creative Photography through Composition I. Practical help for the student to improve his pictures. Review of basic principles of composition and application to the work of the student. Course applies to color slides, color prints, and black and white photographs. How to see a picture. How to present subject matter in interesting fashion. Use of photographs as medium of communication. Night photography. Prize-winning pictures. Pictures for exhibition. Criticism and suggestions on prints and color slides and practice in analyzing and judging photographs. Field trips. Creative Photography through Composition I is not a prerequisite.

8-198. Photojournalism

Fall, 2 credits. Repeated in Spring

FRED S. WITTE

Designed for the student who has achieved high degree of photographic capability and is prepared to advance to subtle aspects of photography. Stress of imagination in picture taking, ability to tell story, or report events with pictures aided with words, and layout. *Prerequisite*: Working knowledge of photography.

8-290. Motion Picture Film Production

Fall, 3 credits

JOHN M. LEWIN, III

Producer. Scripting. Sound. Animation. Editing. Laboratory services. Discussion. Demonstrations. Visual presentations. Guest lecturers from writers, cameramen, directors, and lighting directors. *Prerequisite*: Working position in audio-visual media, either still or motion pictures: Photographers, film editors, cinematographers, or those in positions of managerial or operational responsibility for audio-visual programs.

8-333. Art Appreciation (See P. 122)

8-336. American Art (See P. 122)

8-011. Photographic Roundtable

Fall, non-credit. Repeated in Spring

Opportunity for continued study of photography. The group meets twice each month during the regular school year. One meeting is devoted to constructive analysis of photographic work presented by members; the other meeting is devoted to presentation of information about new developments and techniques in photography and to other topics of current interest. Annual Salon. Open to the student who has completed any of the courses in photography offered by the Graduate School.

8-165. Copy Preparation: Pasteup and Photographic Workshop

Year, 3 credits each semester

HENRY W. BORN, JR.

First semester: Copy preparation—pasteup. Designed to acquaint the student with fundamentals of good composition and layout and application of these principles. Instruction and use of drafting equipment and materials necessary to preparation of mechanicals for advertisements, ruled forms, simple and complex booklets for camera ready copy, using photographs, illustrations and color overlays. Second semester: Laboratory theory and practice in fundamentals of basic photo-lithographic processes as applied in printing medium, including instruction in use of process cameras and other photo-mechanical equipment for preparation of prints and negatives used in pasteup, photographing of complete assignments, stripping of line and halftone negatives, opaquing and engraving of final press negatives, proofing, and making of press plates.

8-170. Survey of Lithography

Year, 3 credits each semester

DAVID REZNIKOFF

Primarily for the lithographic apprentice or those desiring understanding of whole lithographic process. First semester: Development of lithography. Other printing processes and their relationship to lithography. Offset photography, including color. Plate making. Layout and stripping. Second semester: Press work. Copy preparation. Cold and hot composition and photo typesetting. Lithographic ink making and uses. Offset papers, including visit to mill in Pennsylvania. Binding. Advantages and limitations of process. Future trends. Lectures and field trips.

8-171. Offset Stripping and Negative Work

Year, 3 credits each semester

UGO V. GERVASIO

Workshop at apprentice level. Film assembly and stripping procedures and techniques as applied to black and white and simple color register work in photolithography. Survey of stripping. Tools for stripping and their use. Basic mathematics. Opaquing and retouching. Cutting and scribing lines. Negative engraving. Stripping inserts and corrections. Ruling pen practice. Masking halftones and tints. Silhouetting halftones. Quality control problems. Preparing the dummy. Making accurate layouts. Signature imposition. Attaching negatives to flats. Complimentary flats for double printing. Color proving for accurate check. Other stripping problems and procedures. *Prerequisite*: Survey of Lithography, or special permission.

8-174. Offset Photography

Year, 3 credits each semester

WILLIAM J. RANKIN

Workshop at apprentice level. Contact and camera line and halftone negatives for photolithography. Darkroom processing. Contact and mechanical screens. Filters and lens formulae. *Prerequisite*: Survey of Lithography, or equivalent.

8-175. Lithographic Estimating

Fall, 3 credits

WALTER L. ROBERTS

Analysis and procedures of cost estimating. Emphasis on cost finding and its application to preparing estimates. Course emphasis centered on cost center definitions, determination of materials, and time requirements to produce jobs—large and small. Thorough application of cost finding, ranging from copy preparation through bindery. How to review specifications and write up practice estimates. *Prerequisite*: Survey of Lithography, or equivalent, or experience in graphic arts.

Faculty

FACULTY, DEPARTMENTAL, AND SPECIAL COMMITTEES

The year following the name represents the first year of association with the Graduate School

- ABRAHAMSEN, MARTIN A. (1963). Ph.D., Wisconsin. Deputy Administrator, Farmer Cooperative Service, USDA. Taught at North Carolina State and West Virginia. (Social Sciences)
- ABRAMOWITZ, BENJAMIN, (1962). Master Artist. Ford Fellow, National Academy of Design. (Technology)
- ABRAMOWITZ, STANLEY, (1968). Ph.D., Polytechnic Institute of Brooklyn. Research Chemist, National Bureau of Standards, Department of Commerce. Taught at Brooklyn Polytechnic and National Institutes of Health Graduate School. (Physical Sciences)
- ACKERMAN, KARL H., (1967). B.S. in C.E., Tri-State College. Supervisory Navigational Scientist, Head, Navigation Branch, U. S. Naval Oceanographic Office, Department of the Navy. Taught in U. S. Navy. (Physical Sciences)
- ADAMS, ANDREW S., (1968). Ed.D., California. Director, Educational Affairs, Volunteers in Service to America (VISTA), Office of Economic Opportunity. Taught at California, California State Polytechnic College, Fresno State, Nevada and Virginia. (Public Administration)
- ADELSON, SADYE F., (1949). M.A., California. Chief, Food Consumption Branch, Consumer and Food Economics Research Division, Agricultural Research Service, USDA. Retired. (Technology)
- ADKINS, JAMES S., (1964). Ph.D., Wisconsin. Research Biochemist, Division of Nutrition, Food and Drug Administration, Department of Health, Education, and Welfare. Taught at Wisconsin. (Physical Sciences)
- AKERMAN, STEVE, (1969). B.S.E.E., American Institute of Technology. Electronics Engineer, Satellite Communication Division, Defense Communication Agency, Department of Defense. (Technology)
- ALEXANDER, WILLIAM T., (1966). B.S., California State. Chief, Information Systems Branch, Bureau of Prisons, Department of Justice. Taught in Virginia Public Schools. (Mathematics and Statistics and Office Techniques)
- ALGER, MAX W., (1969). B.S., B.A., Denver. Deputy Auditor General, Defense Supply Agency, Department of Defense. (Public Administration)
- ALLEN, HERMAN R., (1966). B.J., Missouri. Public Information Officer, Bureau of Higher Education, Office of Education, Department of Health, Education, and Welfare. (Committee on Information)
- AMABILE, NANDO A., (1967). M.A., Rutgers. Personnel Management Specialist, United States Secret Service. Taught in New Jersey Public Schools and U. S. Dependent Schools (Germany). (Languages and Literature)
- ANDERSEN, NEIL R., (1968). Ph.D., Massachusetts Institute of Technology. Branch Head, Marine Radioisotopes Branch, Research and Development Department, U. S. Naval Oceanographic Office, Department of the Navy. (Physical Sciences)
- ANDERSON, ROCKNE S., (1968). M.A., Columbia University. Oceanographer, Acoustical Oceanography Branch, U. S. Naval Oceanographic Office, Department of the Navy. (Physical Sciences)
- APPLEMAN, PAUL L., (1946). Personnel Staffing Specialist, Bureau of Programs and Standards, Civil Service Commission. Retired. (Public Administration)
- ARMBRECHT, BERNARD H., (1962). Ph.D., Georgetown. Pharmacologist, Bureau of Veterinary Medicine, Food and Drug Administration, Division of Veterinary Research, Department of Health, Education, and Welfare. (Physical Sciences)
- ARMSTRONG, WILLIAM J., (1963). Director, Financial Management Staff, Bureau of the Budget. (Public Administration)
- ASHENDORF, ALTON B., (1969). M.B.A., City University of New York. Plans Officer (International Trade Specialist), Office of International Trade Promotion—Export Market Identification, Bureau of International Commerce, Department of Commerce. Taught at City College of New York and City University of New York. (Social Sciences)
- ASKEGAARD, DAVID, (1950). B.S., North Dakota. Director, Office of Program Analysis, Rural Electrification Administration, USDA. (Technology)
- AULD, A. MICHAEL, (1968). B.F.A., Howard. Illustrator-Designer, National Education Association. Instructor, Washington Technical Institute. (Technology)
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